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# City of Victoria

## Corporate Energy and Emissions Management Plan (CEEMP)

June 22, 2021

Prepared for:

City of Victoria
Victoria, BC

Prepared by:

Stantec Consulting Ltd.
Victoria, BC

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# Glossary of Key Terms

**Internal Cost of Carbon (ICC)** – Also know and a shadow carbon price is a decision-making tool used by a business or organization that sets a theoretical or assumed price on to capture the otherwise hidden costs of carbon pollution such as health and environmental impacts. Adoption of an internal cost of carbon helps organizations reach greenhouse gas reduction targets, manage risk and prepare for a regime of higher carbon taxes.

**Carbon Tax –** Is a government fee imposed on the combustion of most fossil fuels. Both the Federal and Provincial governments impose carbon taxes. In BC it is currently set at $40/tonne. By 2024 it is set to be $50/tonne and by 2030 the Federal government is targeting $170/tonne (equivalent to an extra $0.40 on a litre of gasoline). Rather than set an internal price on carbon some municipalities, such as Saanich, set an internal carbon tax that is used to fund energy retrofits and greenhouse gas emission reduction initiatives.

**Operational Greenhouse Gas emissions** – The Climate Leadership Plan sets corporate greenhouse gas emission reduction targets that apply to the operation of buildings and vehicles. Currently, targets do not apply to capital infrastructure projects except where City vehicles or equipment are utilized.

**Life Cycle Cost (Analysis)** – A method of tracking the financial cost of an asset that considers its capital, operating and disposal costs to guide replacement. Life Cycle Cost Analysis is used to determine the most cost-effective option among different competing alternatives to purchase, own, operate, maintain and, finally, dispose of an asset (or process).

**Life Cycle Analysis (Life Cycle Assessment)** – A method of quantifying the environmental impacts associated with a given product or process. For a commercial product Life Cycle Analysis, an inventory tracks the resources used and pollutants generated in production, use and disposal. To align organizations to global agreements to limit global warming, greenhouse gas emissions tracking will expand from operational emissions to life cycle emissions.

# Executive Summary

The phenomenon of climate change and reducing energy and GHG emissions has been a priority for City of Victoria (the City) since 2007 when the City began tracking its GHG emissions and implementing actions to reduce energy consumption and GHG emissions. Since then, the City has guided policies and strategies that have improved its energy and GHG emissions performance while the community has grown. The result of these actions has been a decline of GHG emissions of more than 17% on an absolute basis, and on an intensity basis (GHG emissions per community resident) of more than 29% below 2007 levels.

As important as these GHG reduction milestones are, they are not enough to align with the level of global emissions reductions required limit global warming and the associated impacts that global GHG emissions may have on our global climate system. To substantially reduce the risks and effects of climate change, scientists and policy makers have come to the agreement that global society must stabilize and reduce GHG emissions to levels to limit global temperatures from rising beyond 1.5°C over the next 30 years. This translates to reducing GHG emissions by 50% by 2030 and more than 80% by 2050.[1] If the current global GHG emissions trajectory continues, scientists estimate that global temperatures could rise by 4 to 6°C this century, resulting in irreversible environmental, social and climatic changes, and result in economic losses ranging from 5% to 20% of global Gross Domestic Product (GDP) annually.[2]

As centers of communication, commerce, and culture, municipal government organizations play an important role in the reduction of GHG emissions and the impacts that climate change can have on a community. They have a leadership role that influences their communities beyond their organization's carbon footprint. On this basis, the City has developed a Climate Leadership Plan (CLP) and set aggressive corporate climate targets requiring a 60% reduction of GHG emissions by 2030 and 80% by 2050 within a triple bottom line accounting system. The City has also set a 100% renewable energy target for 2050, meaning that all fuels consumed are renewable and, ultimately, have low carbon footprints. Although the City has achieved significant reductions in corporate GHG emissions, it recognised that it would not reach its corporate targets without focused planning and investment  The objective of the Corporate Energy Emissions and Management Plan (CEEMP) is to set the City on path to achieving the CLP GHG and renewable fuel targets by establishing short-term initiatives that build momentum and lay the groundwork for deeper energy and GHG emissions reduction actions to be implemented post-2030. The CEEMP covers a 10-year horizon from 2021 to 2030, but also considers the actions needed to achieve the 2050 targets. The CEEMP, together with the corporate climate adaptation plan, will form the environmental backbone of a triple bottom line accounting system for the City to ensure its corporate operations, services and infrastructure bring maximum value to the community it serves.

[1] https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf
[2] http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf

Other than the Provincial carbon tax, there has been little direct cost to the City for emitting GHG emissions to the atmosphere. However, even accounting for fuel savings, the current price of carbon is oftentimes too low to shift the business case away from typical 'like for like' replacements towards low- or no-carbon technologies that have a lower or negative return on investment. To encourage the adoption of low- and no-emission technologies, an internal cost of carbon (ICC) and other measures are recommended to ensure investments are sufficient to meet the environmental goals and targets the City has set.

The CEEMP GHG emission forecasting was based on corporate energy and GHG emissions available for the most current year, 2019, and trends since the 2007 base year as well as anticipated growth to 2050. The identification of initiatives for incorporation into the CEEMP was done through a combination of staff engagement, formerly completed location-based site visits, a best-in-class review of other municipalities and input from internal and external subject matter experts.

To achieve the 2030 GHG reduction target, before 2030, the City should:

- Prepare and implement building decarbonization plans for the Centennial Arcade, City Hall, Crystal Garden, Public Works Buildings, Beacon Hill Park Administration Building and achieve at least a 30% reduction in energy while shifting the energy profiles of each to consume at least 85% electricity.
- Replace Crystal Pool with a low carbon facility and ensure the new Fire Hall #1 operates using renewable energy sources.
- Implement the recommended energy conservation projects. For other facilities or infrastructure, seek out energy projects to reduce energy and GHG emissions.
- Offset the remainder of natural gas emissions through the purchase of renewable natural gas (RNG).
- Implement an ongoing building commissioning and monitoring program to maintain energy conservation and GHG emissions.
- Reduce fleet size by 10% by 2025 and accelerate the conversion of electric and low-carbon fuels using the cost of carbon to support the life cycle replacement cost.
- Establish programs that facilitate more accountability and ownership over greenhouse gas emissions and fuel consumption. .
- Utilize carpools to increase vehicle utilization and reduce overall fuel consumption.
- Convert all equipment to biofuels or electric by 2030.
- Adopt a department-based carbon budgeting process to track progress, build accountability and support decision-making.

The use of RNG is a high-risk approach as there are expected supply and demand issues. It is therefore recommended that the City focus on energy conservation building retrofits and low- or zero-carbon

technologies first and to treat RNG as a scarce resource – to be used only when there are policy or technological barriers (e.g., City Hall's heritage status).

Over the longer term, the achievement of the 2050 energy and GHG reduction targets will require the aggressive conversion of all fleet (including Police) and handheld and off-road equipment to either electric or renewable fuels, and likely adjusting various business models and service levels.

Table E-1 presents the CEEMP short-, medium- and long-term GHG emission reductions based on the estimated potential of the initiatives proposed. As these values can be used as interim targets to track progress against, the carbon targets for each reporting sector are presented in Table E-2. Note: these forecasts align with CLP 2030 and 2050 GHG reduction targets (60% and 80%, respectively) with a small contingency buffer.

### Table E-1. Estimated GHG Emission Reductions By Sector

| Year Ended | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **Buildings & Facilities Emissions Reductions ($tCO_2e$)** | 163 | 1,110 | 1,110 | 1,110 |
| **Fleet Emissions Reductions ($tCO_2e$)** | 404 | 706 | 1,300 | 1,534 |
| **Equipment Emissions Reductions ($tCO_2e$)** | - | 427 | 376 | 381 |
| **Asphalt Plant & Other Infrastructure Emissions Reductions ($tCO_2e$)** | - | 120 | 120 | 120 |
| **Remaining GHG Emissions ($tCO_2e$)** | 3,279 | 1,498 | 802 | 634 |
| **Change from 2007 Base Year** | -29% | -68% | -83% | -86% |

*Notes to table: 2007 Base Year = 4,613 $tCO_2e$*

The GHG emissions by sector are presented in Figure E-1

Overview

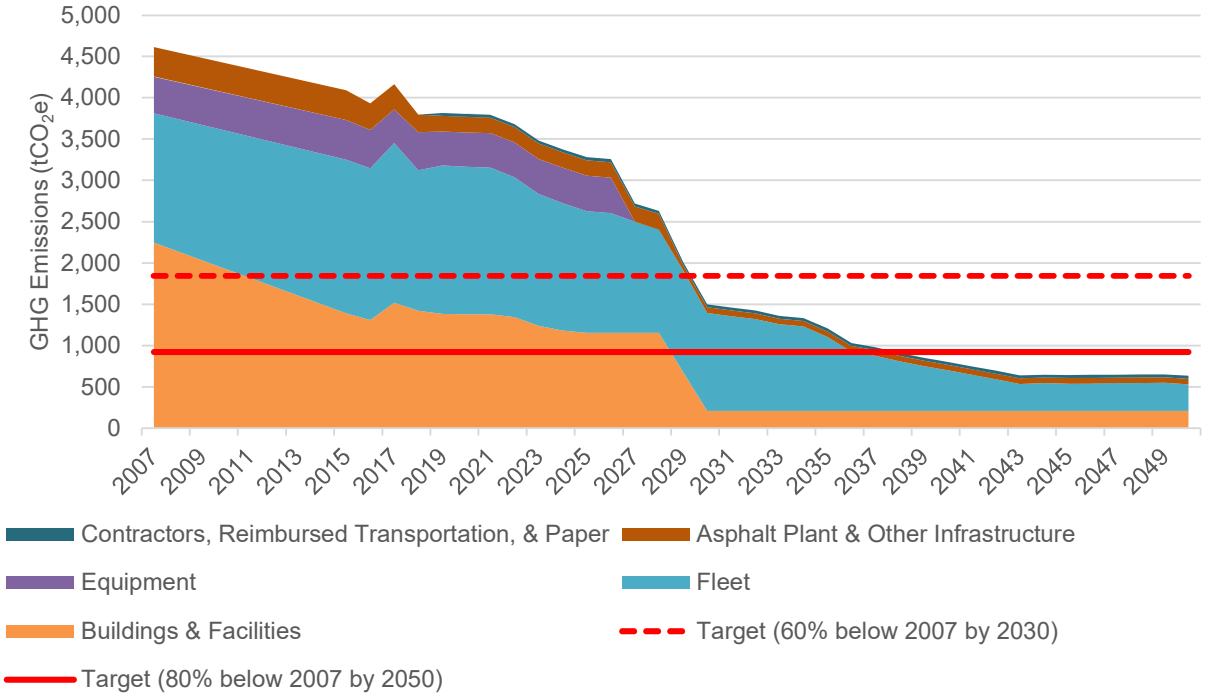


**Figure E-1. Forecasted GHG Emissions By Reporting Sector**

To confidently meet these emission reductions, implementing bold initiatives is not enough, tracking and accountability are required to monitor progress and allow for adjustments to meet unforeseen circumstances. The CEEMP provides an organizational structure and framework to support initiative implementation and progress tracking. The framework's components include an annual report that:

- Tracks current energy and GHG emissions in aggregate and broken down by department and/or division
- Tracks energy and GHG emissions trends from the prior year and the baseline
- Reports progress on actions from the prior year's report.
- Describes work that has been completed.
- Reports progress towards CLP targets.
- Identifies issues or challenges faced in advancing each initiative.
- Indicates progress toward achieving each initiative, using the following scale:
    - Not Started – The initiative has not been implemented.

Overview

  - On Track – The initiative has been implemented.
  - Outstanding – An issue, barrier and/or challenge is prohibiting the initiative from being implemented.
  - Delayed – The initiative has been delayed or placed on hold.
  - Completed – The initiative has been completed.

- Lists new initiatives to address issues, barriers, and challenges.
- Reports timing and assigned responsibilities of the initiatives.

In implementing the CEEMP initiatives, framework and organizational structure described in this plan, the City of Victoria will position itself to achieve its CLP targets.

The proposed initiatives are summarized in Table E-2.

**Table E.2. Summary of CEEMP Plan Initiatives**

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| **Buildings & Facilities** | | | | | |
| B1: Corporate Energy Specialist | Make Corporate Energy Specialist Position a full-time position with responsibilities to support CEEMP Building and Facilities initiatives implementation | Supportive Initiative | Supportive Initiative | 2022 | Facilities<br>Human Resources<br>Climate Action Program |
| B2: Sustainable Buildings Policy & Technical Standards | Update Green Building Policy to require that all newly constructed and deeply renovated buildings meet a minimum of Step Code Level 3 and be Net Zero Ready and require an evaluation of alternative energy sources for new construction and major renovations. | Supportive Initiative | Supportive Initiative | 2022 | Climate Action Program |
| B3: Energy Projects | Implement the following energy projects:<br>• City Hall: LED conversion & lighting control installation<br>• Public Works Facilities: LED conversion and auto shut off<br>• Community Centre Energy Improvements: LED conversions, hot water tank | ~16,000 MWh | ~900 $tCO_2e$ | 2023 | Facilities<br>Climate Action Program |

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| | replacements (gas to electric, where feasible)<br>• Victoria Police Department: LED conversion and lighting control installation<br>• Beacon Hill Park Administration Building and Greenhouses: LED Conversions, hot water tank replacements (gas to electric)<br>• Potting Shed - Furnace to baseboards<br>• Royal Athletic Park boiler fluid replacement | | | | |
| B4: Building Decarbonization Plans | B4a: Building Renewals - Deep Energy Retrofits. Develop building decarbonization plans for large energy consuming and GHG emitting buildings and facilities, and compete deep energy retrofits at:<br>• Crystal Garden<br>• City Hall<br>• Parks Works Yard<br>• Beacon Hill Admin<br>Operate all buildings on RNG. | ~14,500 MWh | ~9,500 $tCO_2e$ | 2030 | Facilities |
| | Decommission the Asphalt Plant | ~15,000 MWh | ~3,000 $tCO_2e$ | 2030 | Facilities |

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| | Replace the following facilities with new facilities:<br>• Crystal Pool<br>• Fire Hall #1 (heated with RNG) | ~7,000 MWh | ~6,000 $tCO_2e$ | 2030 | Facilities |
| B5: Ongoing-Commissioning Program | Prepare and implement an ongoing-commissioning plan. | ~13,000 MWh | ~600 $tCO_2e$ | 2023 | Facilities |
| B6: Energy Performance Monitoring | Use Cartegraph to track and report on building energy performance monitoring and provide users with energy and GHG dashboards. | Supportive Initiative | Supportive Initiative | 2022 | Asset Management |
| **Fleet & Equipment** | | | | | |
| F1: Fleet Resources | Hire a consultant to develop a Green Fleet Plan and review resource implementation requirements | Supportive Initiative | Supportive Initiative | 2022 | Facilities<br>Human Resources |
| F2: Green Fleet Plan | F2a: Telematics Data Analysis: Process fleet telematics data to inform the development of the Green Fleet Plan. | Unknown (5-10%) | Unknown (5-10%) | 2022 | Fleet |
| | F2b: Fleet & Equipment Life Cycle Analysis: Develop a vehicle and equipment life cycle replacement and cost assignment program that feeds into the City's asset | Supportive Initiative | Supportive Initiative | 2022 | Fleet<br>Finance<br>Asset Management |

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| | management and financial systems. | | | | |
| | F2c: Green Fleet Plan: Implement a Green Fleet Plan and associated polices that sets out pathway towards reducing fleet and equipment, increases utilization efficiencies, and aggressively converts all fleet and equipment to low- or no-carbon fuels. | ~64,000 MWh | ~26,000 $tCO_2e$ | 2024 | Fleet<br>Finance<br>Asset Management |
| F3: Corporate Electric Vehicle Pool | Develop a corporate EV pool with supporting infrastructure (i.e., online vehicle booking system, prioritized parking, etc.). This would require realignment of the incumbent fleet of EVs to a more generic bookable fleet. No additional vehicles are required. | Supportive Initiative | Supportive Initiative | 2021 | Fleet<br>Climate Action Program |
| F4: Pilot New Technologies | Continue to use pilot projects utilizing biofuel and electric-powered medium and heavy-duty truck technologies as they become available. | Unknown | Unknown | Ongoing | Fleet |
| F5: Develop a Fleet Electrification Financing Strategy | Develop a three-tiered approach to finance investment in fleet electrification using an internal cost of carbon, a levy and vehicle electrification fund. | Supportive Initiative | Supportive Initiative | 2021 | Fleet<br>Finance |

Overview

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| **Infrastructure Modernization** | | | | | |
| I1: Sustainable Infrastructure Rating System | Investigate a policy that requires all corporate infrastructure or building / facility capital projects over $100,000 be assessed under the Envision ISI Framework. | Supportive Initiative | Supportive Initiative | 2025 | Operations |
| I2: Life Cycle Considerations | Integrate LCA processes into budget and capital planning, strategic planning, purchasing policies, preventative maintenance plans, environmental management plans, and asset management. | Supportive Initiative | Supportive Initiative | 2023 | Operations<br>Finance<br>Procurement |
| I3: Reduce Infrastructure Energy Consumption | Complete energy efficiency reviews on non-building and fleet infrastructure, examining systems as a whole as well as reviewing individual components for efficiency opportunities. | Unknown (5-10%) | Unknown (<1%) | Continuing | Facilities<br>Operations |
| I4: Alternative Energy Sources | Install renewable energy systems, where there is a business case, or the implementation supports CLP guiding principles of leadership, providing to access to renewable fuels | Unknown | Unknown | Ongoing | Climate Action Program |

Overview

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| **Corporate Leadership** | | | | | |
| L1: Internal Cost of Carbon (ICC) | Establish a policy that requires the use of an ICC of $150/tCO2e (expressed as a cost) in asset and infrastructure decisions such as vehicle procurement and building acquisition and modification. | Supportive Initiative | Supportive Initiative | 2021 | Operations |
| L2: Modify Climate Action Reserve Fund Policy | Modify existing energy savings policy to require that the energy efficiency savings be channeled to the Climate Action Reserve Fund (CARF) | Supportive Initiative | Supportive Initiative | 2021 | Climate Action Program |
| L3: Employee Transportation Demand Program | Continue to implement policies that allow for more flexible work environments and dis-incentivize travel. | Supportive Initiative | Supportive Initiative | Ongoing | Climate Action Program |
| L4: Environmental Procurement Program | Develop and implement a Sustainable Products Ranking Framework and Program that more clearly prioritizes products and services that reduces / conserves operational energy use and GHG emissions. | Supportive Initiative | Supportive Initiative | 2025 | Procurement |

Overview

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| L5: Departmental GHG Accounting & Reporting | Develop a methodology to assign energy consumption and GHG emissions to each department. | Supportive Initiative | Supportive Initiative | 20 22 | Climate Action Program |

# 1.0 OVERVIEW

Climate change has emerged as the next unprecedented social, economic, and environmental challenge facing our society today. It poses a serious threat to global quality of life, jobs, and physical and natural assets. Many scientists believe that the human-production of greenhouse gas (GHG) emissions since pre-industrial times have already surpassed the Earth's "carrying capacity" of natural systems and pose significant risks of change for mankind to come.

The phenomenon of climate change and reducing energy and GHG emissions has long been a priority for City of Victoria (the City) since 2007 when the City began tracking on GHG emissions performance and implementing actions to reduce energy and GHG emissions. Since then, the City has guided policies and strategies that have improved its energy and GHG emissions performance while the community has grown. The result of these actions has been a decline of GHG emissions of more than 20% on an absolute basis, and on an intensity basis (GHG emissions per community resident) of more than 29% below 2007 levels.

In recognition of the importance of climate change, the City released its 2018 Climate Leadership Plan (CLP) that commits the City to an 80 percent reduction in GHG emissions (below 2007 levels) and switching to 100 percent renewable energy by 2050. In the context of corporate energy and GHG emissions, the CLP committed the City to achieving the following targets:

- By 2040, all City facilities are powered 100 percent by renewable energy.
- All new City facilities are renewably powered.
- By 2025, all City power tools, and small engine-driven equipment are renewably powered.
- By 2040, 80 percent of the City fleet is electrified or renewably powered.

To help the City track progress and make mid-course corrections as it works towards the 2050 commitments, the CLP established a target to reduce the City's corporate GHG emissions by 60 percent by 2030.

The achievement of the 2030 and 2050 targets will require the City to examine and redesign in how it delivers services and manages infrastructure from parks and underground utilities to the City's procurement processes. This will be pursued through the development of the Corporate Energy and Emissions Management System (CEEMP) that weaves energy efficiency and GHG performance into City plans and policies. The City's reductions in energy and GHG emissions are expected to materialize by focusing on three key actions: upgraded efficiency in buildings, improved vehicle efficiency and reduced fuel demand, and a progressive shift from fossil-fuel burning equipment to those running on electricity, renewable natural gas, hydrogen, or advanced biofuels.

# OVERVIEW

The CEEMP provides the relevant information that makes energy and GHG emissions performance visible to various levels of an organization, enabling individuals and departments to plan, prioritize and manage energy and GHG reduction programs in an integrated fashion that aligns with City policies, programs, procedures, standards, practices, regulations, and information. Implementation of the CEEMP can lead to long-term financial and productivity improvements through the continuous monitoring, management, and control of energy and GHG emissions.

Figure 1 presents the elements of the CEEMP and the various processes that it can support. It shows that an effective CEEMP requires communication, integration, and a commitment to continuous improvement to achieve rapid reductions in energy and GHG emissions and maintaining that performance over time.

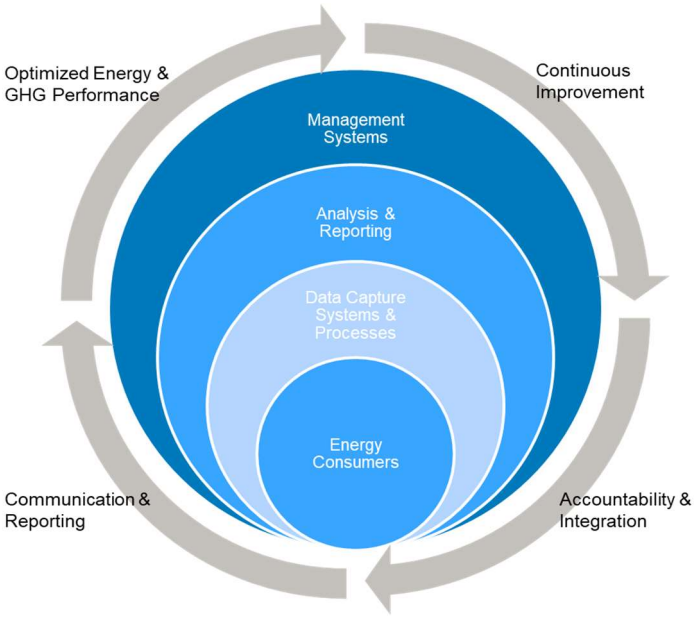


**Figure 1. CEEMP Operational Profile**

It should be noted that there is no ‘one size fits all’ approach to energy and GHG management. As the purpose of using a CEEMP is to establish the systems and processes that enable energy and GHG improvement actions, the organizational context, culture, and accountability systems that drives these actions are paramount to the CEEMP overall success. The development of a revolving 3-year Strategic Energy Management Plan (SEMP) is one such action that will assist and complement the CEEMP in achieving its objective. The SEMP will establish short and medium-term energy reduction targets and will prioritize and track initiatives to reduce corporate energy consumption.

# SCOPE

The CEEMP is a corporate-wide 10-year plan and system that focuses exclusively on energy and GHG emissions resulting from the City's service delivery to Victoria residents. It does not include community generated energy or GHG emissions that are outside the geographic boundary of the City.

Calculating corporate municipal GHG emissions can be complicated because of how City services are delivered and by who delivers them (e.g. contractors). To be relevant, GHG inventories must reflect the operations of a City and the way in which it interacts with the community. At the same time, it is important that the GHG inventory conform to international standards for reporting to ensure consistency and comparability with other cities. To this end, the City's energy and GHG boundary has been set following an "operational control" approach where the City should track energy and GHG emissions of an asset when:

- The City owns or leases the asset; and
- The City is responsible for maintenance and capital upgrades.

Only emissions over which the City has operational control – i.e., the City owns and is responsible for maintenance and capital upgrades of the asset – are included in this CEEMP. For example, the City owns the Greater Victoria Public Library, but is not responsible for maintenance and capital upgrades and thus the GHG emission sources are not included in the GHG inventory as the responsibility for these aspects would fully reside with those responsible for the upkeep and operations of the library.

Should the City wish to influence performance of such an asset, it would be through advocacy and contractual changes (e.g. leases) and not through the CEEMP. Over time, the City may consider extending this boundary to include third-party operations that the City can influence – for example, contracted services and construction. The inclusion of these assets and activities would require a change in the baseline and targets. Figure 2 below illustrates the relationship between the GHG emissions and the scope of the CEEMP.


**Figure 2. Scope of the CEEMP**

The recommendations made for the first five years integrate planned initiatives from each of the City's core areas of business and are based on estimated of energy and GHG reduction potential from existing and proven technologies. Actions in the medium-term planning horizon shift momentum towards more targets. These program components provide City with an opportunity to slow GHG emissions growth. Initiatives identified in the long-term are expected to be more transformational in nature. These initiatives are based on best available technology to date but recognize that the business case for selecting specific solutions will need to be identified in the coming years. Potential changes to federal and provincial legislation, funding opportunities, as well as technological advances over future decades will further strengthen the City's progress towards its climate leadership goals.

# CEEMP DEVELOPMENT PROCESS

The CEEMP is based the 2019 corporate energy and GHG emissions reporting year and trends since the 2007 base year. The identification of initiatives for incorporation into the CEEMP was done through a combination of city staff workshops, interviews, and a best-in-class review of other municipalities.

Three thematic workshops – focused on buildings and facilities, fleet and equipment, and procurement and finance - facilitated sharing of best practices and identification of key initiatives with City staff providing specific guidance and direction on the CEEMP components, initiatives, and enabling factors. These were completed between March and April 2019. A review of energy conservation and GHG

policies, programs, and initiatives from peer cities and municipalities was also conducted and included an assessment of the following cities and municipalities:

- Canada: City of Vancouver, City of North Vancouver, City of Burlington, City of Toronto, City of Edmonton, City of Calgary
- United States: New York City, City of Seattle, City of San Francisco
- Europe: London, United Kingdom
- New Zealand: City of Auckland

Topics which were covered during the reviews included:

- Actions for energy conservation and GHG emissions
- Energy and GHG reduction targets and performance against targets
- Financing approaches
- Barriers and challenges
- Recommendations

The CEEMP was reviewed by key managers, assistant directors and the Senior Leadership Team prior to being finalized

# 2.0 CORPORATE ENERGY & GHG EMISSIONS

With climate change related GHG emissions at the forefront of public awareness and policy development, municipal governments are incorporating strategies to both manage the anticipated impacts and reduce their energy consumption and GHG emissions footprint. Many of these efforts have focused on reducing building energy and fleet fuel consumption as these sources are the largest contributors to an organizations' GHG emissions profile.

## CURRENT ENERGY & GHG EMISSIONS

The City owns 97 major facilities, which cover a total area of over 1.8 million square feet ($ft^2$) (167,000 square meters ($m^2$)) and maintains 1.4 million $ft^2$ (167,000 $m^2$). The City is also responsible for traffic and streetlights, water and wastewater systems, and a fleet of approximately 400 vehicles and equipment to provide public services. These service areas make up the City's corporate energy consumption and GHG emissions and contributes to serving the residents, businesses, and visitors.

In 2019, the City' s corporate energy consumption was 29,604 MWh. In terms of GHG emissions, the consumption of fossil fuel powered energy resulted in the estimated release of 3,815 tonnes of carbon dioxide equivalent ($tCO_2e$)[3]. The consumption of energy and associated GHG emissions were the direct result of the provision of key services by the City, which are organized into the following categories.

- **Buildings & Facilities**: The City's building and facilities consume electricity and natural gas to heat, cool, ventilate, and illuminate administrative, police, and fire buildings, park facilities, and community and recreation centers.
- **Fleet**: The City's fleet vehicles includes police, fire, construction vehicles, and light duty vehicles for corporate use. The majority of vehicles consume gasoline and diesel.
- **Equipment**: The City owns and operates over 800 pieces of small and large equipment to which almost 14% is electrically powered. The non-electrically powered equipment is powered by gasoline and diesel.
- **Asphalt Plant & Other Infrastructure**: The City operates an asphalt recycling plant which operates on both natural gas and electricity. Other infrastructure assets include over 6,000 streetlights, traffic signals, bus shelters, parkades, and also underground infrastructure like pumping stations to which most of these assets are powered by electricity.
- **Contractors, Reimbursed Transportation, & Paper**: As part of ongoing operations, the City contracts services, like waste collection, and procures materials, like paper, all of which have an energy and GHG emissions footprint.

[3] This figure differs from the public reported figure, which follows provincial reporting guidelines and does not include VicPD or the City's asphalt plant.

Table 1 presents the breakdown of the 2019 energy and GHG emissions by typical reporting category.

### Table 1. 2019 Corporate Energy and GHG Emissions by Category

| Category | Energy (kWh) | Percent (%) | GHG Emissions ($tCO_2e$) | Percent (%) |
|---|---|---|---|---|
| Buildings & Facilities | 14,955,860 | 51% | 1,381 | 36% |
| Fleet | 7,941,930 | 27% | 1,799 | 47% |
| Equipment | 1,793,255 | 6% | 412 | 11% |
| Asphalt Plant & Other Infrastructure | 4,913,142 | 17% | 187 | 5% |
| Contractors, Reimbursed Transportation, & Paper | 0 | 0% | 35 | 1% |
| **Total**[4] | **29,604,187** | **100%** | **3,815** | **100%** |

When energy and GHG emissions are aggregated by sector, buildings, and facilities account for 50 percent of the City's energy consumption and 36 percent of GHG emissions (Figure 3 & Figure 4). Fleet accounts for a much smaller percentage of the City's energy profile (27 percent) but has a higher GHG contribution (47 percent) as fuels like gasoline and diesel have a higher GHG emissions intensity. The same applies to equipment – low energy contribution (8 percent), with a higher GHG profile (11 percent). Other stationary assets include streetlights and other stationary energy sources are large consumers of energy (17 percent), but most of these assets run on electricity which has a very low GHG emissions intensity resulting in a low contribution to the City's overall GHG inventory (5 percent). Lastly, contractors, reimbursed transportation, and paper account for 1 percent of the City's GHG emissions.

[4] Values are higher than what has been reported in the City's CARIP report as the CEEMP energy and GHG emissions inventory includes policing and other emissions outside CARIP scope.

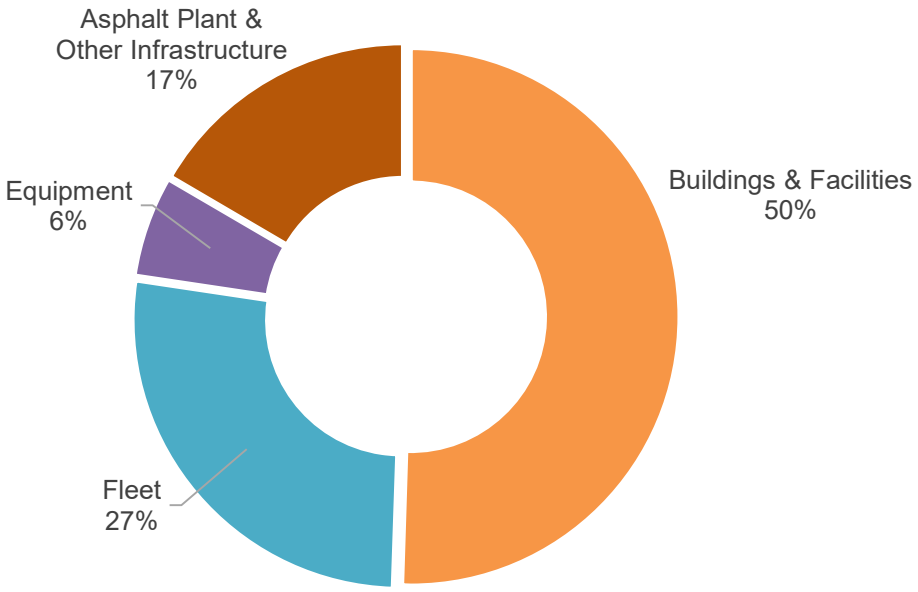


**Figure 3. 2019 Corporate Energy Consumption By Sector**

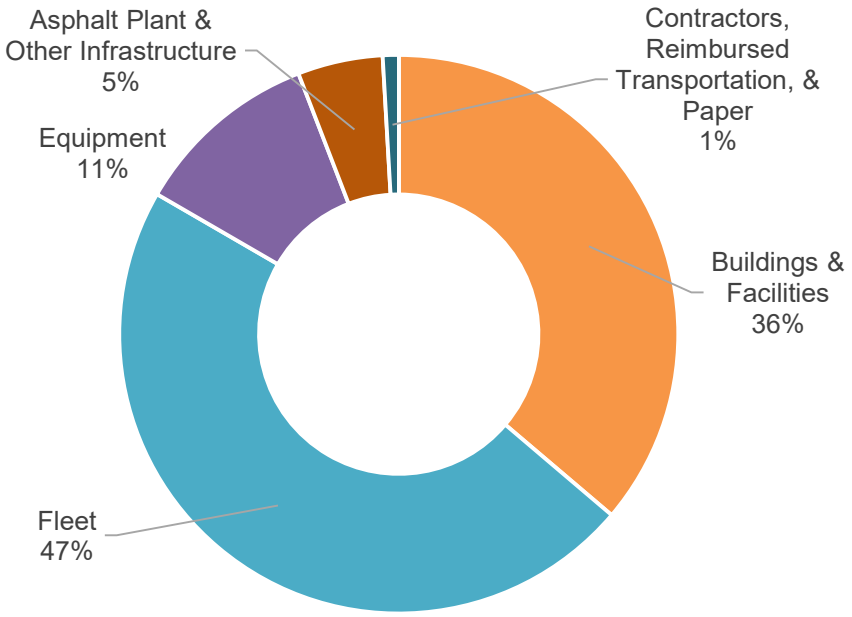


**Figure 4. 2019 Corporate GHG Emissions By Sector**

# DEPARTMENT / FUNCTION ENERGY & GHG EMISSIONS

In terms of department and function, in 2019, the top energy consumers and GHG emitters include parks, recreation and facilities, public works and engineering, fire and police. This is presented in Table 2.

### Table 2. 2019 Energy and GHG Emissions by Department / Function

| Department / Function | Energy (kWh) | Percent (%) | GHG Emissions ($tCO_2e$) | Percent (%) |
|---|---|---|---|---|
| Parks, Recreation and Facilities | 7,090,254 | 24% | 905 | 24% |
| Public Works & Engineering | 12,455,474 | 42% | 1,735 | 45% |
| Fire | 1,419,036 | 5% | 205 | 5% |
| Police | 4,290,081 | 14% | 632 | 17% |
| Other Operations and Services, Finance, Planning, Etc. | 4,349,342 | 15% | 337 | 9% |
| **Total** | **29,604,187** | **100%** | **3,815** | **100%** |

A more detailed breakdown of the above sources are presented in Table 3.

### Table 3. Breakdown of 2019 GHG Emissions by Department / Function

| Department | Function | | | | Total | % |
|---|---|---|---|---|---|---|
| | Buildings | Fleet | Equipment | Assets | | |
| **Total** | **1,381** | **1,799** | **412** | **223** | **3,815** | **100.0%** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Parks, Recreation and Facilities** | | | | | **905** | **24%** |
| Community Centers | 61 | | | | | |
| Recreation Facilities | 547 | | | | | |
| Facilities - Pandora | 0 | | | | | |
| Parks Facilities | 142 | | | | | |
| Parks Fleet - Facilities Division | | 12 | | | | |
| Parks Fleet - Parks Division | | 52 | | | | |
| Parks Equipment | | | 91 | | | |

| Department | Function | | | | Total | % |
|---|---|---|---|---|---|---|
| | Buildings | Fleet | Equipment | Assets | | |
| **Public Works & Engineering** | | | | | **1,735** | **45%** |
| Public Works | 101 | | | | | |
| Engineering (City Hall, Pandora) | 9 | | | | | |
| Public Works Fleet | | 1,112 | | | | |
| Engineering Fleet | | 5 | | | | |
| General Equipment | | | 321 | | | |
| Asphalt Plant | | | | 120 | | |
| Other Infrastructure | | | | 68 | | |
| | | | | | | |
| **Fire** | | | | | **205** | **5%** |
| Fire Stations | 84 | | | | | |
| Fire Protection Fleet | | 121 | | | | |
| | | | | | | |
| **Police** | | | | | **632** | **17%** |
| Police Stations | 150 | | | | | |
| Police Fleet | | 481 | | | | |
| | | | | | | |
| **Other Operations And Services, Finance, Planning, Etc.** | | | | | **337** | **9%** |
| Other - Facilities (Legislative, City Hall) | 69 | | | | | |
| Other - Pandora | 1 | | | | | |
| Other - Arcade | 16 | | | | | |
| Other - Planning | 32 | | | | | |
| Other - Finance | 18 | | | | | |
| VCC[5] | 149 | | | | | |
| Other Fleet | | 17 | | | | |
| Contractors, Reimbursed Transportation, & Paper | | | | 35 | | |

[5] While the main Victoria Conference Centre operates on BC Hydro power and renewable natural gas, the Crystal Gardens facility uses conventional gas heating.

## HISTORICAL TRENDS

The City chose 2007 as its base year. Since 2007, the City's population has increased over 16 percent while energy and GHG emissions from corporate operations have decreased 20 and 17 percent, respectively. The relationship between absolute and per capita GHG emissions is illustrated in Figure 5 below.

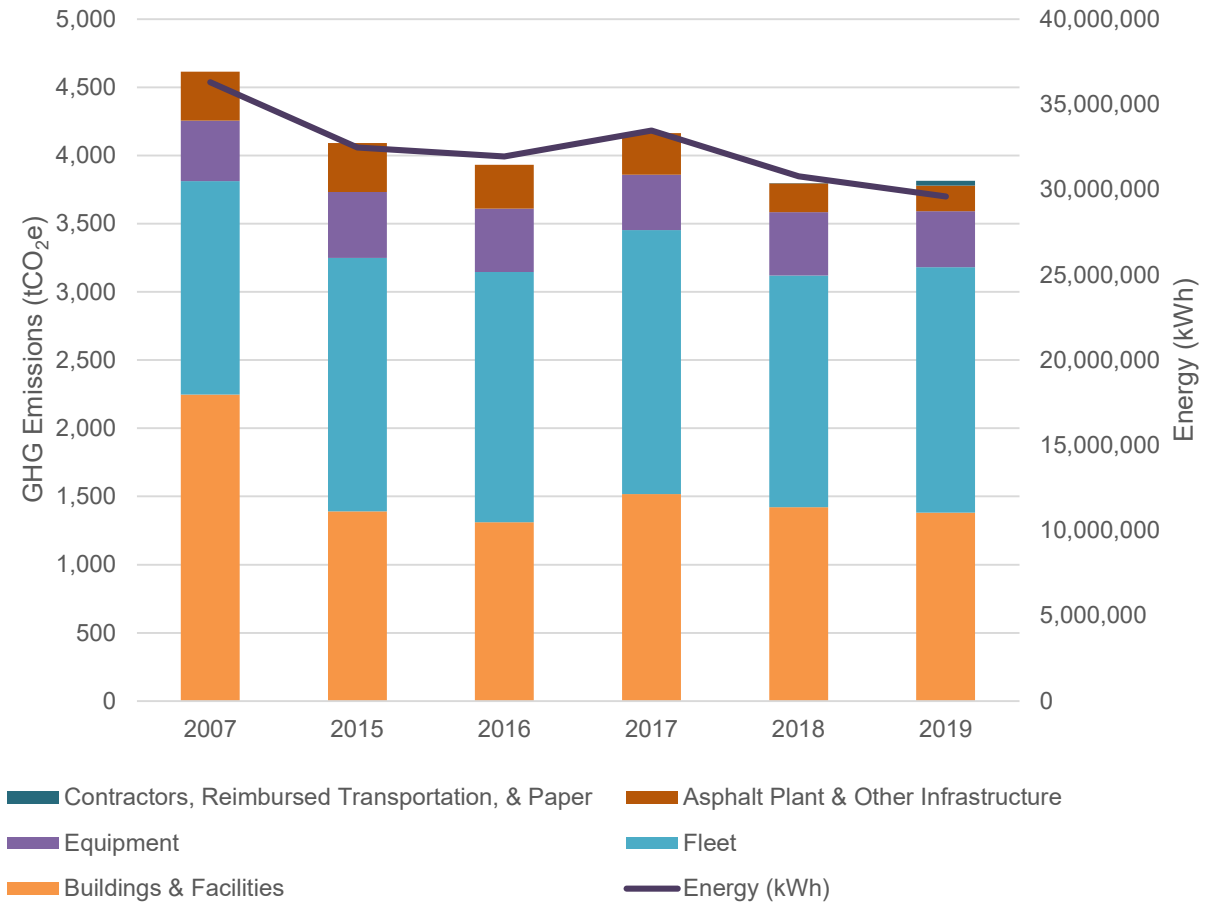


**Figure 5. 2007 - 2019 Energy and GHG Emissions Trends By Reporting Sector**

Building energy use intensity (EUI) and GHG emissions intensity (GHGI) are industry accepted metrics to benchmark the performance of the City's portfolio over time and to other municipal portfolios in similar geographies. Assessing buildings on an energy intensity basis allows the identification of the high energy consuming buildings relative to their size as these buildings have the most potential to generate significant energy savings. Figure 7. Building & Facility Energy Use & Intensity Trends and Figure 8

presents the buildings City's EUI, and GHGI since the 2007 baseline year.

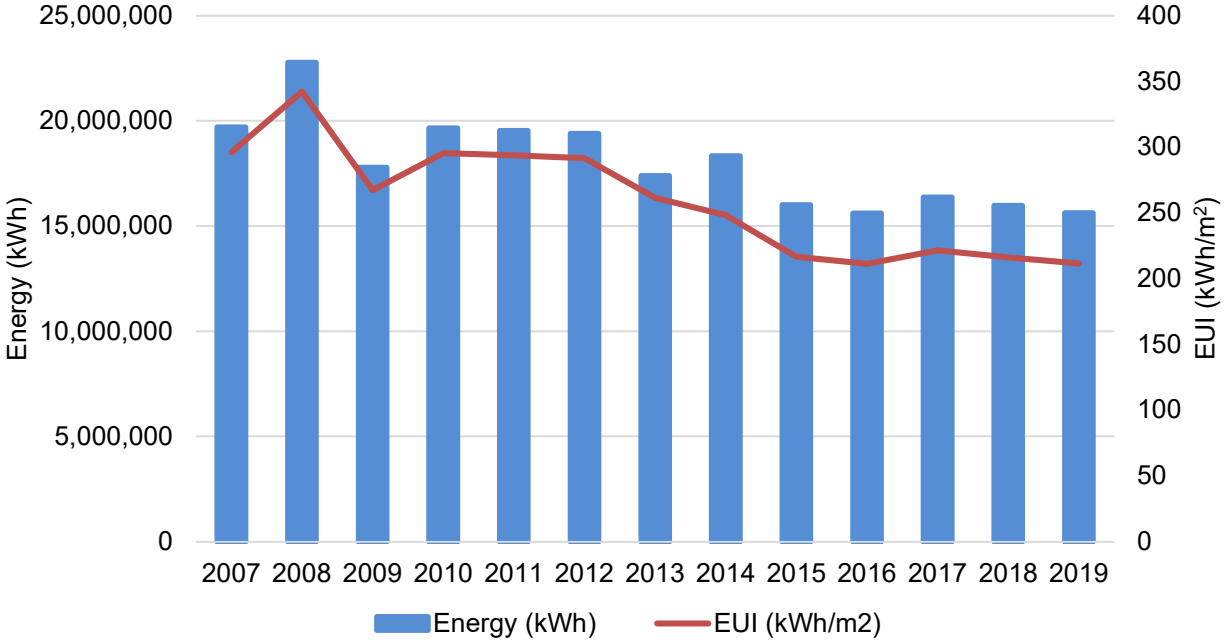


**Figure 6. Building & Facility Energy Use & Intensity Trends**

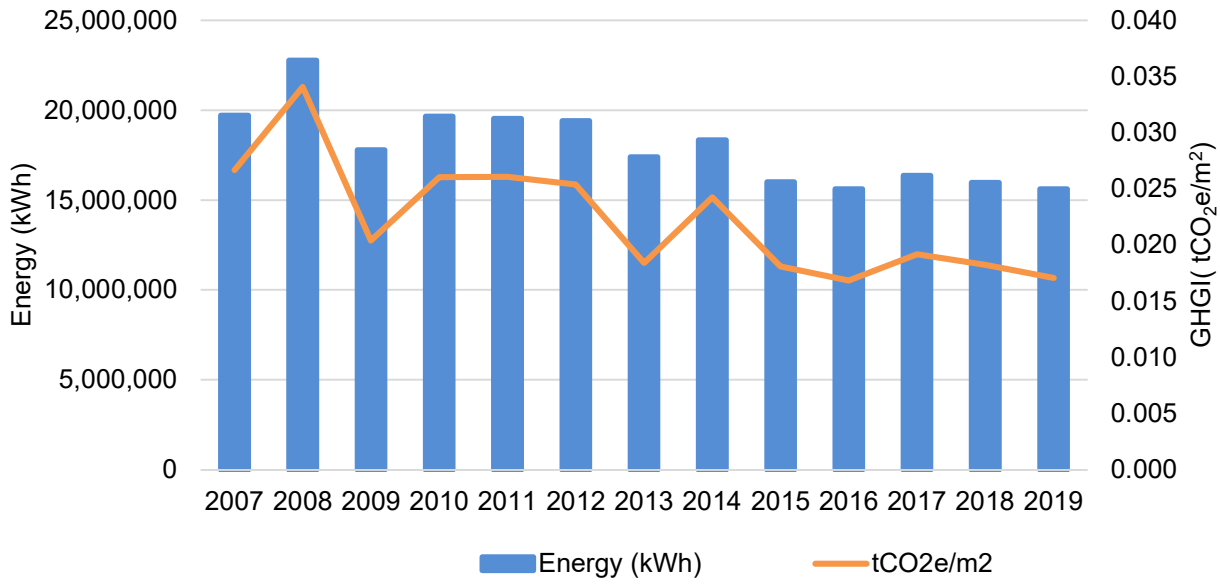


**Figure 7. Building & Facility Energy Use & GHG Emissions Trends**

# CORPORATE ENERGY AND GHG FORECAST

## Business as Usual (BAU) Energy and GHG Emissions Forecast

A business as usual (BAU) energy and GHG emissions forecast was developed for the CEEMP to understand what the City's footprint would look like in 2030 and 2050 as well as examine the potential magnitude of energy and GHG reduction opportunities (Figure 9). Assuming the City does not implement any of the energy saving and GHG emissions reduction initiatives recommended in the CEEMP, the City's corporate energy consumption is estimated to exceed 29,4600 MWh by 2050 – a decline of 19 percent over 2007 levels and a 1 percent decline over 2019 levels. In terms of GHG emissions, the City's 2050 business as usual GHG footprint is estimated to be 3,800 $tCO_2e$ – a decrease of 18 percent from the 2007 base year GHG emissions and no real change from the 2019 reporting year.

The forecast assumes that the City can continue servicing the growing community utilizing existing building assets but requires additional fleet and equipment. The forecast also assumes that the following changes to the existing assets occur:

- Fire Station #1 is replaced with more energy efficient facilities and are renewably powered.
- The addition of the mechanics building to Fire Station #3 occurs and is renewably powered.
- A 20% reduction in energy occurs at the Beacon Hill Park Greenhouses as a result of energy projects.

The forecast accounts for initiatives set by the Federal government (e.g. federal vehicle corporate fuel-economy standards). The forecast did not account for the possible divestiture of the Victoria Conference Center (VCC) in 2037 when the lease agreement expires as it is not known if the City would seek to establish a new agreement. Divesting of the VCC is a possible option to reduce energy consumption, associated costs and reducing GHG emissions and should be considered as part of the business case assessment when the renewal comes due.

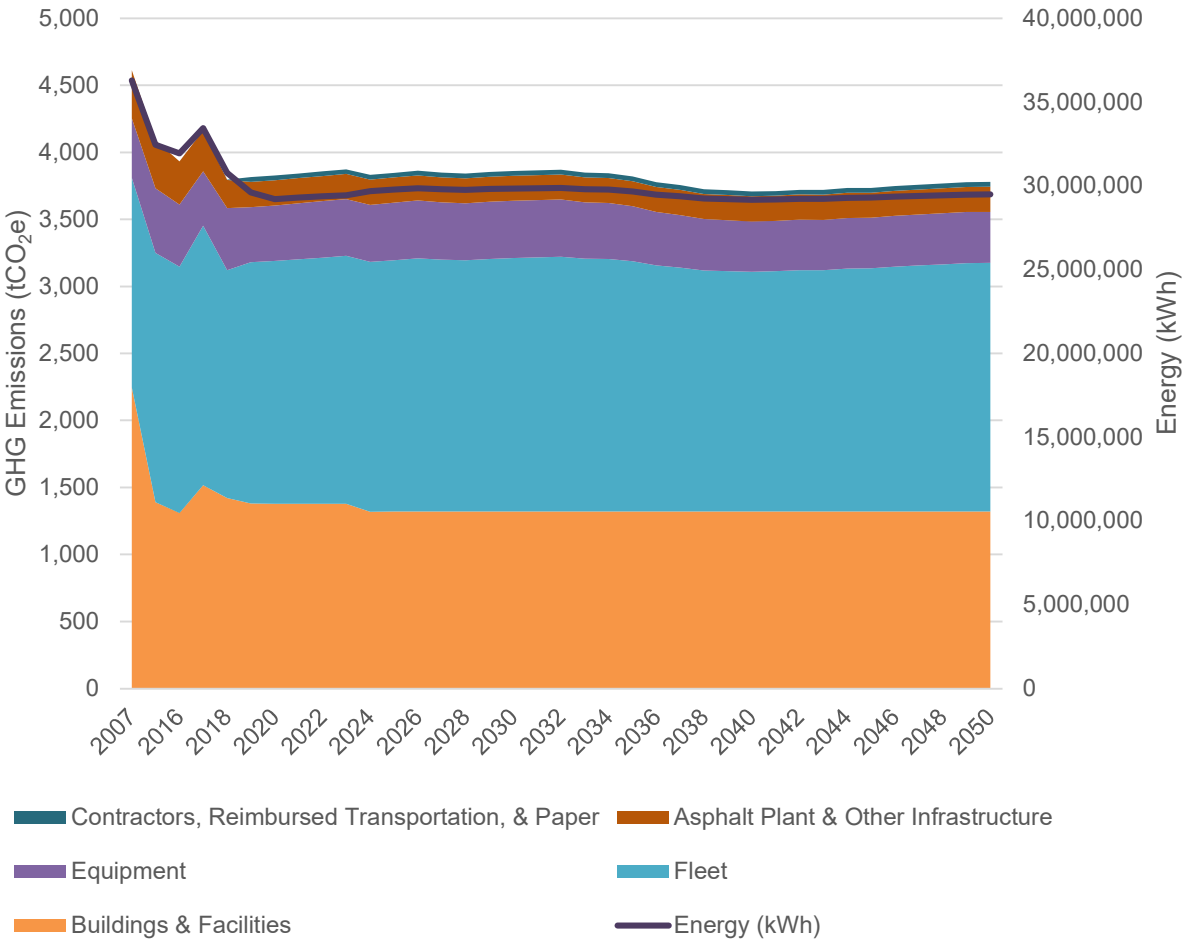


**Figure 8. Business As Usual Energy And GHG Emissions Forecast**

## Energy Costs

It can be safely assumed that electricity and natural gas rates are predicted to increase by about 3% per year with other fuels like gasoline and diesel increasing by about 2% per year. Naturally, rising energy costs will negatively impact ongoing operating costs making energy conservation and demand management even more important to help mitigate these rising costs. Without a dedicated focus on reducing and conserving energy, corporate energy costs are expected to climb to over $3.4 million by 2030, over $4.3 million by 2040, and to $5.6 million by 2050. This is presented in Figure 10.

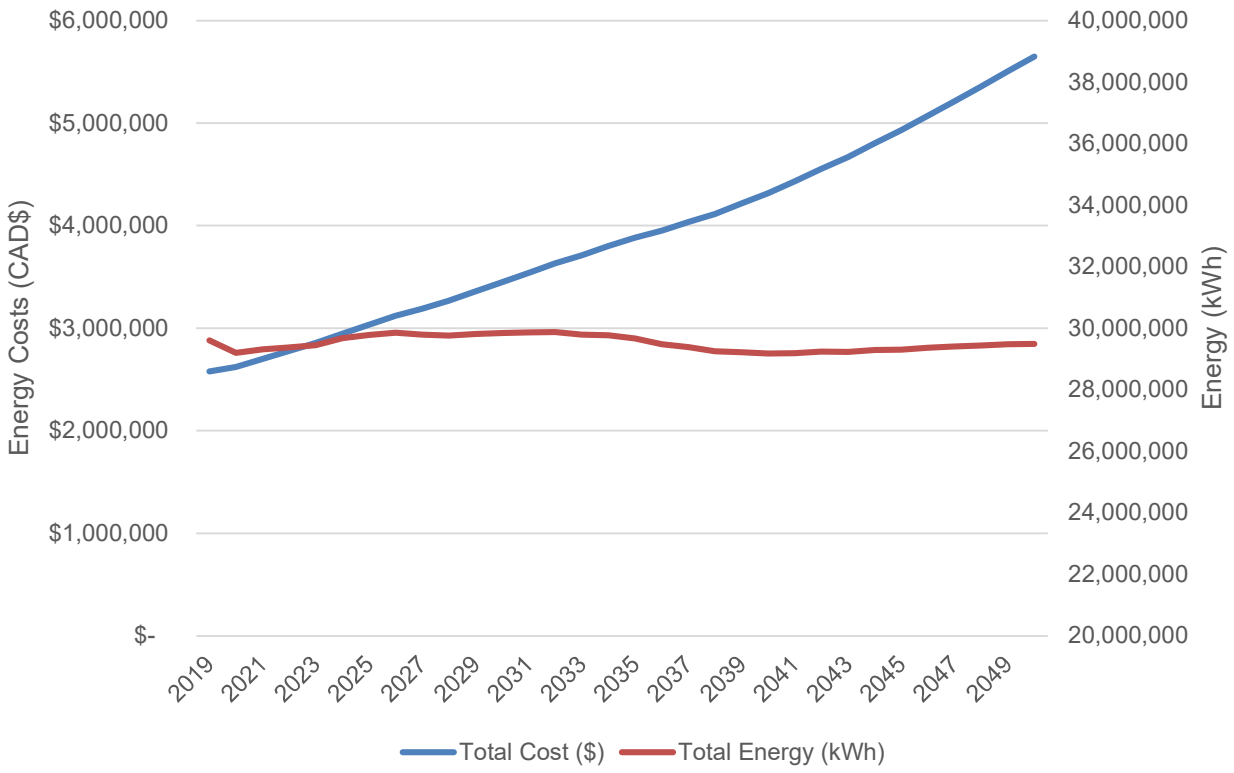


**Figure 9. Estimated BAU Energy Consumption & Costs**

## Progress Towards 2030 and 2050 Targets

To understand the effect of future energy and GHG savings initiatives as it relates to the 2030 GHG reduction target, the business as usual future scenario was adjusted to reflect the estimated energy and GHG emissions savings if the City were to implement the initiatives proposed in the CEEMP. The recommended list of initiatives presented in the following sections could result in a 57 percent reduction by 2030, or a decrease of nearly 1,900 $tCO_2e$ as compared to the 2007 levels (Figure 11). The achievement of the 2030 GHG reduction target will only be realized if the City invests heavily in fuel switching projects at the facility, fleet, and equipment level, decommissions the asphalt plant, and offsets the remaining natural gas GHG emissions through the procurement of renewable natural gas (RNG).

Achievement of the 2050 GHG reduction target will require considerable effort and will require the electrification of light duty emergency fleet which includes patrol vehicles and inspection vehicles.

The forecast showing the contribution of each GHG wedge is presented below in Figure 11.

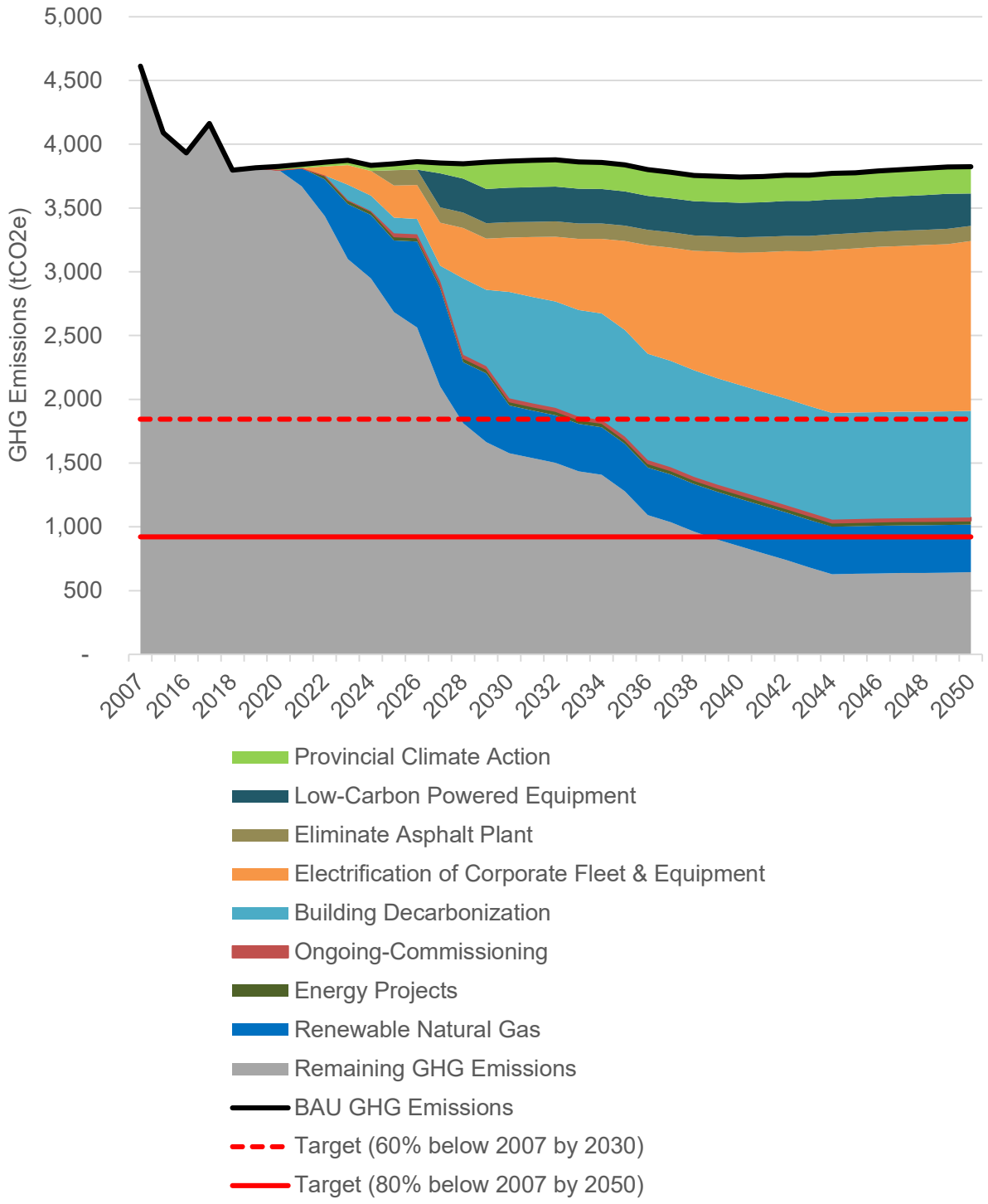


**Figure 10. Forecasted GHG Emission Reductions By CEEMP Initiative Category**

Figure 12 presents the remaining GHG emissions by sector.

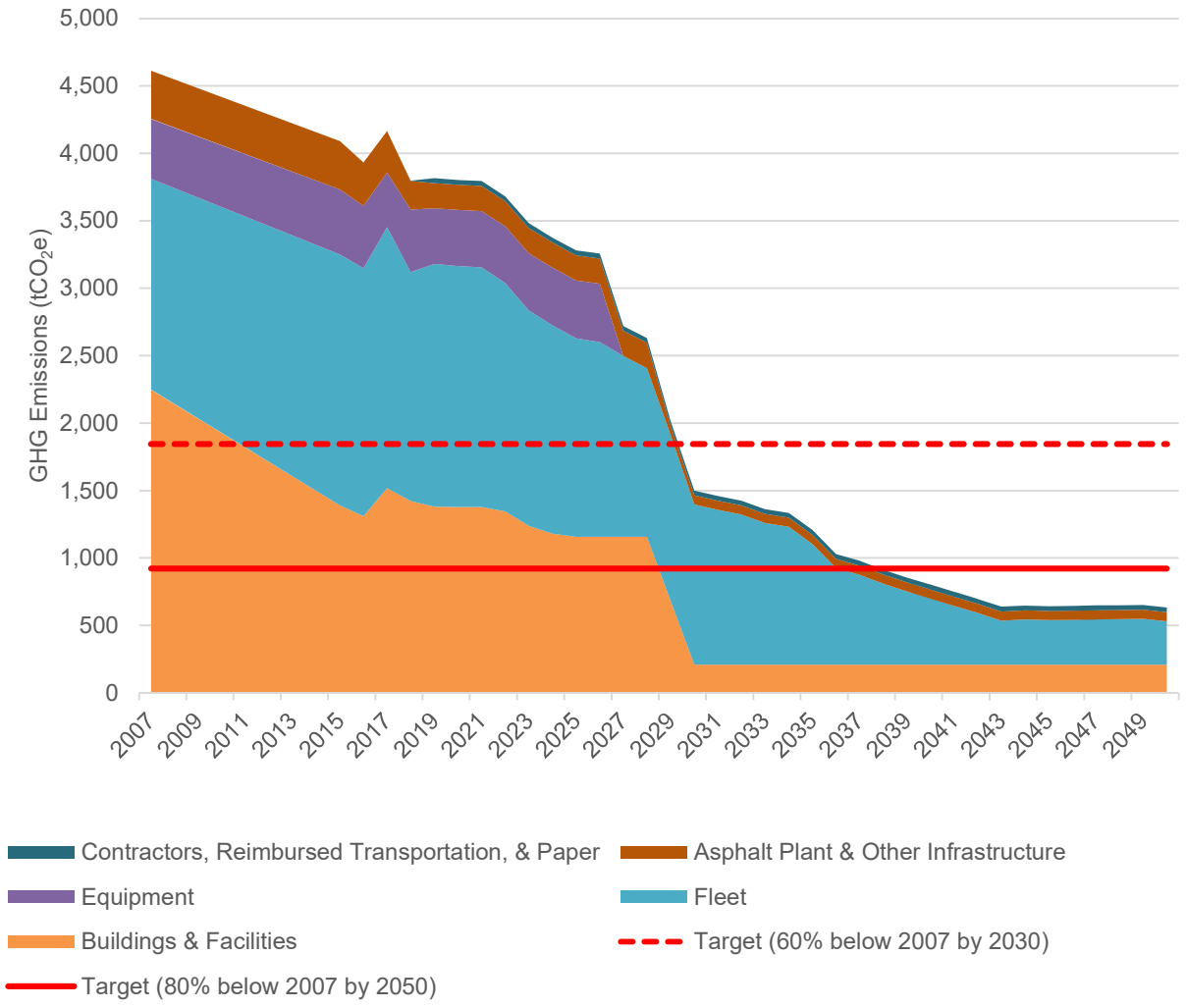


**Figure 11. Forecasted GHG Emissions By Reporting Sector**

The energy forecast is presented in Figure10. The energy forecast shows that the City can reduce total corporate energy consumption by 26 percent and 30 percent by 2030 and 2050, respectively.

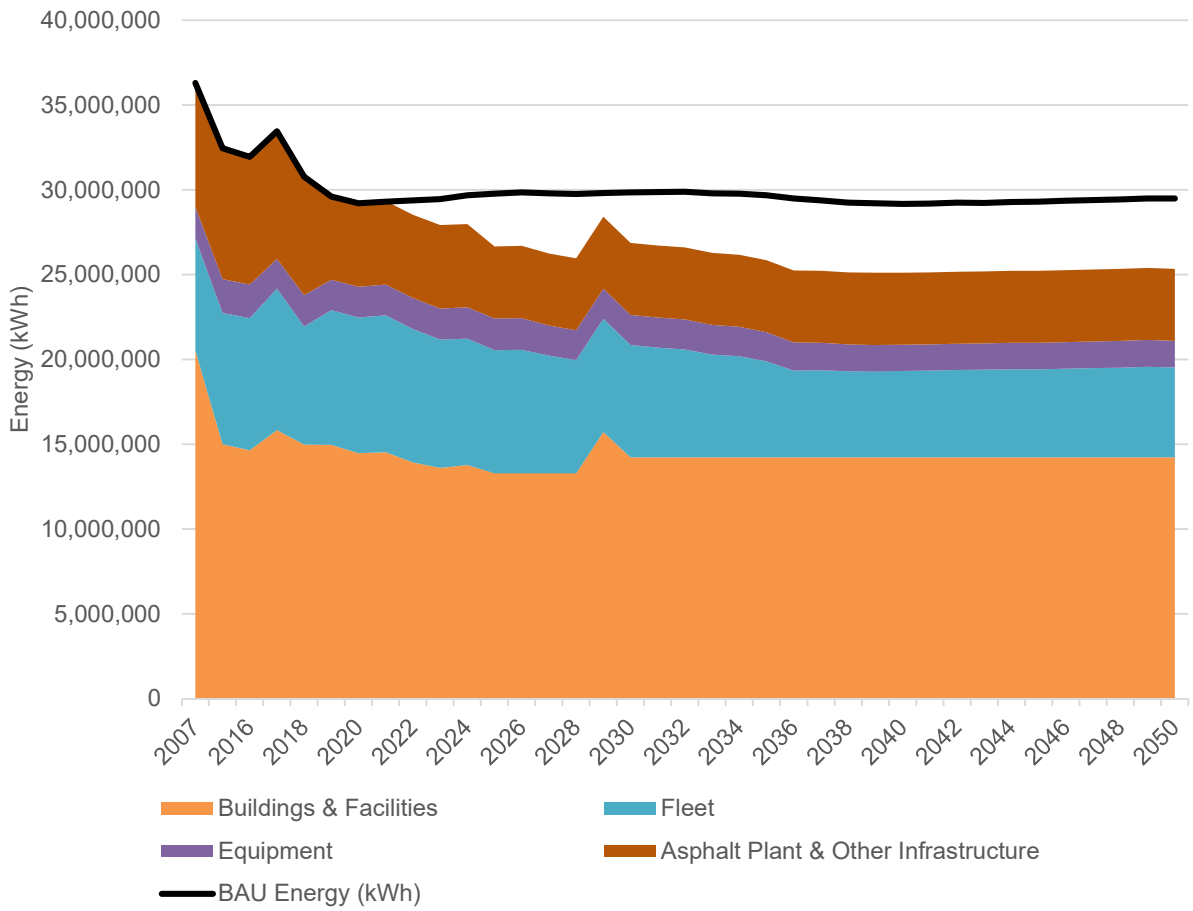


**Figure 12. Forecasted Energy Consumption**

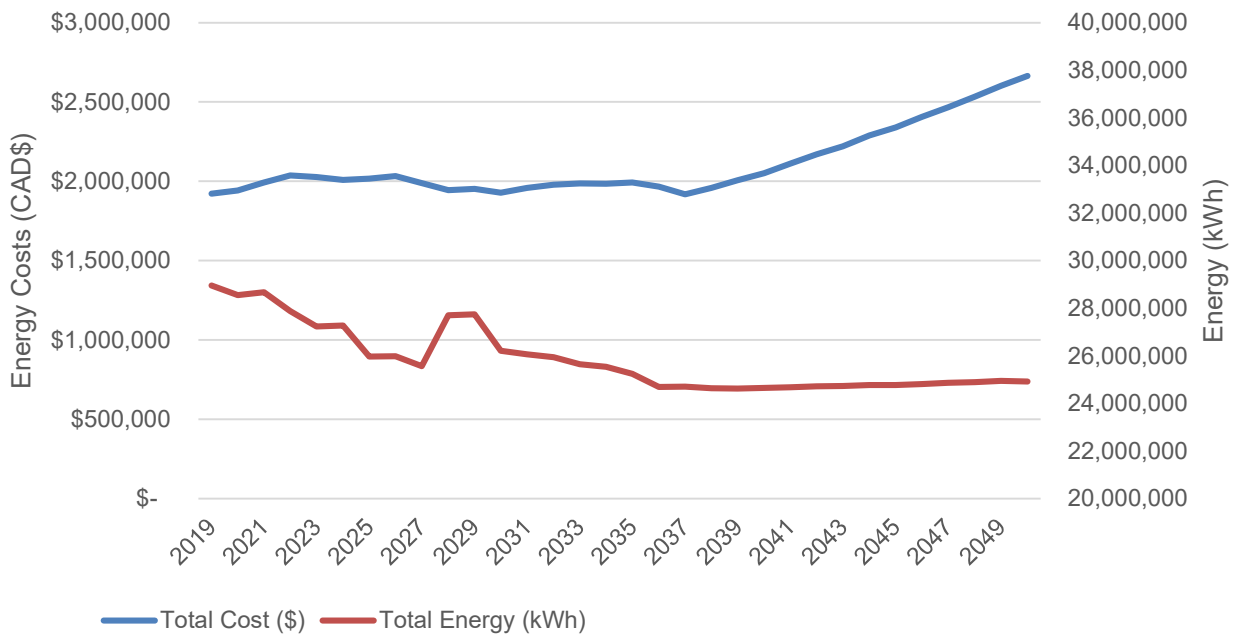


**Figure 13. Estimated CEEMP Energy Consumption & Costs**

To achieve the 2030 GHG reduction target, before 2030, the City will need to:

- Prepare and implement building decarbonization plans for the Centennial Arcade, City Hall, Crystal Garden, Public Works Buildings, Beacon Hill Park Administration Building and achieve at least a 30% reduction in energy while shifting the energy profiles of each to consume at least 85% electricity.
- Replace Crystal Pool and Fire Hall #1 with energy efficient low carbon facilities powered by renewable fuels.
- Implement the recommended energy conservation projects. For other facility or infrastructure, seek out energy projects to reduce energy and GHG emissions.
- Offset the remainder of natural gas emissions through the purchase of renewable natural gas (RNG).
- Implement an ongoing building commissioning and monitoring program to maintain energy conservation and GHG emissions.
- Reduce fleet size by 10% by 2025 and accelerate the conversion of electric and low-carbon fuels using the cost of carbon to support the life cycle replacement cost.
- Establish programs that facilitate more accountability and ownership over greenhouse gas emissions and fuel consumption.
- Utilize carpools to increase vehicle utilization and reduce overall fuel consumption.

- Convert all equipment to biofuels or electric by 2030.

The use of RNG is a high-risk approach as there are expected supply and demand issues. It is therefore recommended that the City focus on energy conservation building retrofits and low- or zero-carbon technologies first and to treat RNG as a scarce resource – to be used only when there are policy or technological barriers (e.g., City Hall's heritage status).

Over the longer term, the achievement of the 2050 energy and GHG reduction targets will require the aggressive conversion of all fleet (including Police patrol and administrative vehicles) and handheld and off-road equipment to either electric or renewable fuels, and likely adjusting various business models and service levels.

Table 4 presents the CEEMP short-, medium- and long-term GHG emission reductions based on the estimated potential of the initiatives proposed. As these values can be used as interim targets to track progress against, the reductions for each reporting sector are presented in Table 4.

### Table 4. Estimated GHG Emission Reductions By Sector

| Year Ended | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **Buildings & Facilities Emissions Reductions ($tCO_2e$)** | 163 | 1,110 | 1,110 | 1,110 |
| **Fleet Emissions Reductions ($tCO_2e$)** | 404 | 706 | 1,300 | 1,534 |
| **Equipment Emissions Reductions ($tCO_2e$)** | - | 427 | 376 | 381 |
| **Other Stationary Assets Emissions Reductions ($tCO_2e$)** | - | 120 | 120 | 120 |
| **Remaining GHG Emissions ($tCO_2e$)** | 3,279 | 1,498 | 802 | 634 |
| **Change from 2007 Base Year** | -29% | -68% | -83% | -86% |

*Notes to table: 2007 Base Year = 4,613 $tCO_2e$*

# 3.0 BUILDINGS & FACILITIES

The City owns or leases 97 building and facilities including: community centers, corporate offices, park facilities, police and fire stations, recreation centers, garages, and vehicle storage facilities. The City has a Green Building Policy which states that all new buildings achieve a minimum LEED® Silver certification. To date, the City has one building that has achieved a LEED® certification level, and one that is BOMA Best certified.

The City's buildings and facility portfolio accounted for 50 percent of its energy use in 2019 and 36 percent of its annual GHG emissions. With an average lifecycle of 50+ years, many, if not most, of the City's current building stock will still be operational in 2050. Green building certifications are an important first step toward reducing GHG emissions from energy consumption but achieving zero-carbon emitting buildings will require more than the current policy of LEED® Silver certification for new buildings. With the City adopting the BC Step Code, all new buildings will need to be "net-zero energy ready' which means they will be highly efficient buildings that can easily accommodate future renewable energy add-ons, such as rooftop solar panels, that will enable them to produce at least as much energy as they consume. Existing buildings and facilities will require deep energy retrofits that radically overhaul the building envelop to reduce energy needs or a complete replacement of the building to a higher energy standard.

With a portfolio of 97 building and facilities, to move towards the 2030 target, the City will need to immediately minimize energy and GHG emissions from its largest GHG contributors which includes City Hall, Public Works, Beacon Hill, Crystal Pool, Crystal Garden, and the Police Headquarters over the next 10 years. A summary of building and facility energy and GHG emissions is presented in Table 5.

**Table 5. 2019 Energy And GHG Emissions By Building**

| Facility | Energy (GJ) | Percent (%) | GHG Emissions ($tCO_2e$) | Percent (%) |
|---|---|---|---|---|
| Crystal Pool | 3,720,045 | 19% | 550 | 36% |
| Beacon Hill | 1,099,008 | 6% | 143 | 9% |
| City Hall (And Annex) | 1,379,745 | 7% | 156 | 10% |
| Police Headquarters | 2,108,838 | 11% | 176 | 12% |
| Public Works Buildings | 1,143,195 | 6% | 113 | 7% |
| Crystal Garden | 780,747 | 4% | 130 | 9% |
| Firehalls | 906,651 | 5% | 92 | 6% |
| Other Facilities | 5,713,499 | 29% | 243 | 16% |
| Victoria Conference Center (VCC) | 2,121,196 | 11% | 55 | 4% |
| Parks | 228,123 | 1% | 10 | 1% |

| Facility | Energy (GJ) | Percent (%) | GHG Emissions ($tCO_2e$) | Percent (%) |
|---|---|---|---|---|
| Asphalt Plant | 667,956 | 3% | 120 | 8% |
| **Total** | **19,869,002** | **100%** | **1,522** | **100%** |

Maintenance and ongoing-commissioning programs - a process of ongoing monitoring, adjustment, and retrofitting with new technologies like building automation systems upgrades, and energy sub-metering will be key to maintaining energy and GHG reductions. Building condition assessments (BCA) and behavioral change programs are also important initiatives that will complement retrofit and building monitoring programs. One of the most cost-effective GHG emissions avoidance measures is to improve existing building utilization rates therefore minimizing the number of new buildings requiring construction in the future.

The City's forecast of office space needs for the corporation estimates that to serve the projected annual year-over-year population growth of 1 percent, staff levels will also need to increase over the same period. Policies that support enhanced staff mobility, hoteling, and improved space layouts, are currently being examined and modified as a result of COVID-19 to achieve the same level of functionality and comfort without the need for additional buildings or facilities. If additional buildings are needed, it remains undetermined what the form of ownership this will take (i.e. construct new, purchase existing, or lease). In cases, where new buildings are leased, the City will need to use spaces that are energy efficient and operate on no-/low-carbon fuel sources and require that the landlord maintain these priorities through the adoption of green leases.

At the time of the development of this CEEMP, only the buildings already planned or in construction were considered. Using increased facility utilization methods, the CEEMP proposes that no new administrative building floor space will be added to the City's portfolio. Although no additional buildings were included beyond this, the CEEMP accommodates the need to replace older less functional buildings that are beyond refurbishment. The buildings initiatives presented herein leverage existing programs already underway, which include the adoption of the BC Step Code for new construction, the ongoing implementation of building condition assessments and energy audits, the implementation of energy data management systems, building sub-meters, data analytic systems, and building energy management dashboards for operational staff.

The following is a list of the proposed building initiatives that are discussed in detail in the following sections:

- B1: Corporate Energy Specialist
- B2: Sustainable Buildings Policy & Technical Standards
- B3: Building Energy Projects
- B4: Building Decarbonization Plans:
    - B4a: Building Renewals - Deep Energy Retrofits

  - B4b: Building Removals And Replacements

- B5: Ongoing-Commissioning Program
- B6: Energy Performance Monitoring

Compared to the 2007 base year, the business as usual building GHG emissions are expected to remain relatively stable by 2050 as no additional buildings or facilities are expected to be constructed or divested (Table 6). With the proposed building and facility initiatives and using RNG, the City can reduce building and facility GHG emissions by upwards of 90 percent by 2050.

### Table 6. Estimated GHG Emission Reductions From Buildings & Facilties

| Year Ended | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| Buildings & Facilities Emissions Reductions ($tCO_2e$) | 163 | 1,110 | 1,110 | 1,110 |
| Other Infrastructure Emissions Reductions ($tCO_2e$) | - | 120 | 120 | 120 |
| Remaining GHG Emissions ($tCO_2e$) | 1,360 | 277 | 277 | 277 |
| Change from 2007 Base Year | -39% | -88% | -88% | -88% |

*Notes to table: 2007 Base Year = 2,606 $tCO_2e$*

Figure 14 illustrates the progression of GHG emissions reductions over time and identifies important milestones considered by the CEEMP in the development of short- and medium-term targets. The figure compares the forecasted emissions with the business as usual forecast and shows the impact from proposed initiatives.

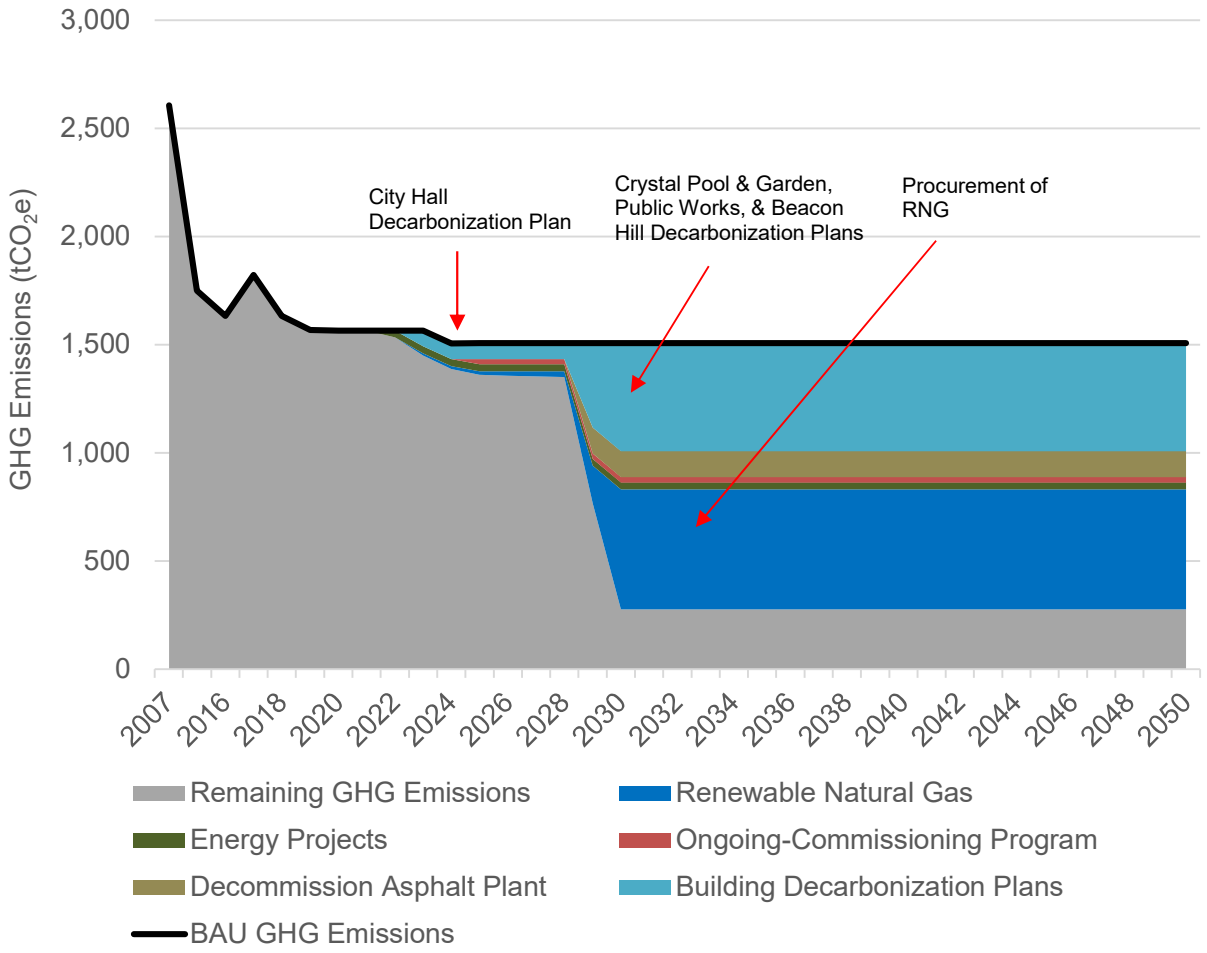


**Figure 14. Forecast of Buildings GHG Emissions**

# BUILDING CEEMP INITIATIVES

The CLP requires that all City facilities be powered by renewable energy by 2040, and that all new facilities are powered by renewable energy. Converting these targets into action requires the establishment of a sustainable buildings program that addresses all aspects of a building's energy operation – from construction and operation to the management and the adoption of renewable technologies and low-carbon fuels.

## B1: Corporate Energy Specialist

The implementation of the proposed building initiatives will require the City to make the Corporate Energy Specialist role a full-time position with responsibilities to support CEEMP Building and Facilities initiatives implementation.

## B2: Sustainable Buildings Policy & Technical Standards

The City recently adopted the BC Step Code which states that from January 2020 residential and commercial construction in the City of Victoria will achieve a minimum of Step 3 which is 20% more efficient than the current building code. It is recommended that the City update its Green Building Policy to align with this community policy requiring that all newly constructed and deeply renovated City buildings meet a minimum of Step Code Level 3 and be Net Zero Ready.

Supporting the Green Building Policy would be technical standards that direct contractors and project staff to focus on specific areas of performance that are important to the City (e.g. reduction of GHG emissions, conservation of energy and water, waste diversion, sub-metering, etc.).The technical standards are important to balance Step Code's focus on energy efficiency and the need for the City to reduce its corporate GHG emissions. For example, energy efficiency targets set by the Step Code can be met using a range of mechanical systems that result in higher GHG emissions.

Strong enforcement of technical standards and accountability would also limit the number of future retrofits and change orders. It is recommended that the City develop these technical standards, and process with clear lines of accountability for all parties involved with the design, construction, operational management, and major renovation of City buildings.

## B3: Building Energy Projects

Several building energy audits have been completed to which recommendations have been made. These energy audits review building thermal performance, load distribution, existing equipment and controls schedules, occupancy patterns, lighting, and efficiency systems to identify energy and emission reduction opportunities. Typical recommendations range from lighting system upgrades, building automation systems (BAS) upgrades, the use of insulation and weather-stripping to installing variable speed motors, and the installation of heat recovery systems. The immediate implementation of the following energy reduction projects will need to be implemented prior to 2025:

- City Hall: LED conversion & lighting control installation
- Public Works Facilities: LED conversion and lighting controls
- Community Centre Energy Improvements: LED conversions, hot water tank replacements (gas to electric, where feasible)
- Victoria Police Department: LED conversion and lighting control installation
- Beacon Hill Park Administration Building and Greenhouses: LED Conversions, hot water tank replacements (gas to electric)
- Potting Shed - Furnace to baseboards
- Royal Athletic Park boiler fluid replacement

The City will need to continue to complete comprehensive energy audits, implement the recommendations, and track the progress of energy audits and projects in the City's asset management system – Cartegraph.

## B4: Building Decarbonization Plans

Operating all facilities on renewable energy sources by 2040 and achieving a subsequent 80 percent reduction in GHG emissions by 2040 will require a unifying de-carbonization plan for each City building and facility. De-carbonizing existing buildings will require deep energy retrofits that upgrade or replace equipment and building envelopes (e.g. roof, walls, windows) to achieve large energy and greenhouse gas emission reductions. The objective of deep energy retrofits is to create a building that can be heated and cooled with the minimum of energy. Deep energy retrofits involve at a minimum:

- Replacing the roof if necessary, but minimally adding insulation.
- Replacing fenestrations (e.g. doors, windows, louvers, etc.)
- Harnessing sunlight for heat and illumination
- Replacing the HVAC systems with renewable technologies like ground-source heat pumps.

A study conducted by Natural Resources Canada (NRCAN) estimates that deep energy retrofits can achieve upwards of a 60 per cent reduction in energy consumption and a similar reduction in GHG emissions. The building decarbonization plans will require to re-think building operations as well as heating, ventilation, and air conditioning (HVAC) systems. A significantly reduced building energy demand means smaller mechanical systems and options for cleaner fuel sources. Electrically driven heat-pumps generate significantly fewer GHG emissions than a natural gas boiler or furnace but may cost more to operate. The final step to de-carbonize City buildings will be to offset any remaining natural gas consumption through the purchase of RNG.

The CEEMP recognizes that deep energy retrofits require a significant capital investment and that the City has not accommodated for them in its current ten-year budgets. Over the next 5-years, the City should develop long-term de-carbonization plans for each of its high energy consuming and GHG emitting buildings and facilities. Having a plan will align the end-of-life rehabilitation initiatives for individual building components (e.g. roof, windows, mechanical equipment, etc.) with the City's climate leadership targets. It is recommended that the de-carbonization plans include asset specific GHG intensity (GHGI) targets, and a business case assessment (utilizing an internal cost of carbon) that clearly defines capital budget requirements and the offsetting energy cost savings that will be reflected in future operating budgets. In collaboration with finance, a timeline that targets 2040 for all existing buildings and facilities to have had a deep energy retrofit completed is necessary if the City is to achieve its 2040 targets.

### B4a: Building Renewals - Deep Energy Retrofits

It is recommended that as part of planning for deep energy retrofits that the City begin completing building specific deep energy retrofit plans with the objective of implementing the energy retrofit when there are

planned rehabilitation and renovation activities and house this information in the City's asset management systems. This will enable the City to forecast and plan for additional capital costs, forecast RNG requirements and provide Council with a clear business case as to why the upgrades are occurring and the rationale for not seeking a 'like-for-like' replacement long before the capital is required.

Prior to 2030, a series of high priority deep energy retrofit projects need to be completed – these include the Centennial Arcade, Crystal Garden, City Hall, Parks Works Yard, and Beacon Hill Administration. The estimated energy reduction and energy split for each of these buildings and facilities is presented below.

### Table 7. Summary of Anticipated Changes to Facility Energy Profiles

| Facility | Estimated Energy Reduction | Implementation Year | Energy Split | |
|---|---|---|---|---|
| | | | Natural Gas | Electricity |
| Centennial Arcade | 30% | 2020 | 0% | 100% |
| City Hall | 30% | 2024 | 25% | 75% |
| Crystal Garden | 60% | Before 2030 | 30% | 70% |
| Public Works | 30% | Before 2030 | 20% | 80% |
| Beacon Hill Park Admin | 30% | Before 2030 | 20% | 80% |

As previously noted, the City will need to develop decarbonization plans for the remainder of its building stock (e.g., Police Station) which has a recommended completion of year of 2025. The City will need to be careful to balance the competing objectives between this initiative and the SEMP in that the SEMP is seeking to reduce electrical energy consumption while the decarbonization of some buildings might result in an increase in electrical energy use. However, this increase in energy use could be offset through the use of renewables like solar PV.

**B4b: Building Removals and Replacements**

The City's building portfolio includes a number of buildings and facilities that are currently, or that will soon reach the end of their operational life or lease – for example, the Asphalt Plant. At that time, as part of each building and facility decarbonization plan, a decision will have to be made regarding whether to redevelop, revitalize, or remove the asset. Along with considering the needs of the City, health and safety, and its residents, the decision should also consider the current and future energy performance, costs, GHG emissions and impact to the City's GHG emissions baseline and forecast. Taking a more holistic and life cycle view of the asset being reviewed, will ensure that the City considers the long-term impacts of each building addition, removal, and replacement option. Taking such a lens is critically important to assets that the City may elect to remove (e.g., VCC in 2037) or add in the future (e.g., SOFMA).

Within the next decade, it is likely that the City will need to decommission and remove the asphalt plant as part of the Public Works Master Plan. Furthermore, it is assumed the City will be replacing Crystal Pool and Fire Hall #1 with low-carbon energy intensity replacements prior to 2030.

### Table 8. Summary of Anticipated Changes to Facility Energy Profiles

| Facility | Estimated Energy Reduction | Implementation Year | Energy Split | |
|---|---|---|---|---|
| | | | Natural Gas | Electricity |
| Asphalt Plant: Removal | 100% | Before 2030 | 100% | 0% |
| Crystal Pool: Replacement | -60% | Before 2030 | 15% | 85% |
| Fire Hall #1: Replacement | 30% | Before 2030 | 35% | 65% |

## B5: Ongoing-Commissioning Program

Commissioning verifies that a building has been constructed to its proper specifications. The best time to commission a building is during construction, with special attention being paid to the building envelope. The building envelope influences most aspects of building performance such as energy consumption, occupant comfort and durability over the life of the entire building (40+ years).

Ongoing commissioning is the continuous commissioning of a building's entire systems over a specified period of time (typically every 1-2 years) to verify continuous peak performance over its useful life. Ongoing-commissioning and re-commissioning are important because they reduce operating costs, reduce the risk of failures, and inform retrofit opportunities and deep energy retrofit plans. Various pre- and post-implementation commissioning case studies have showed efficiency improvements on the order of 5% to 30% because of improved operations and maintenance. The studies also showed that the resulting simple payback periods are typically less than 2 years[6].Typical commissioning activities include:

- Adjusting reset and set-back temperatures and temperature settings;
- Staging/sequencing of boilers, chillers, and air handling units;
- Adjusting and repairing dampers and economizers;
- Modifying control strategies for standard hours of operation;
- Eliminating simultaneous heating and cooling;
- Air and water distribution balancing and adjustments; and
- Verifying controls and control sequencing, including enabling and re-enabling automatic controls for set points, weekends, and holidays.

It is recommended that the commissioning of buildings be scheduled on at least a five-year cycle or when the function of a building or facility changes, and that an ongoing-commissioning program be developed, managed, and tracked by the Facilities department in conjunction with the City's asset management system. To limit the impact of occupant behavior on building performance, it is also recommended that

[6] Office of Energy Efficiency and Renewable Energy, 2010. *Operations & Maintenance Best Practices: A Guide to Achieving Operational Efficiency,* https://www.energy.gov/sites/prod/files/2013/10/f3/omguide_complete.pdf August 3, 2018.

the City use change management techniques to help occupants understand and adapt to the defined parameters (i.e. temperature range, light, air flows, etc.) for conditioned spaces.

## B6: Energy Performance Monitoring

Low-energy buildings do not always operate as they were designed resulting in poor energy performance. Annual energy performance reporting, whether through Energy Star Portfolio Manager or a third-party energy management system (such as Reliable Controls), can close the gap between predicted and actual energy use. Providing building operators with energy management dashboards will enable them to benchmark their energy performance against prior year data and buildings in the portfolio that are of similar typology to identify underperformers and the need for improvements.

It is recommended that the City use its existing asset management system – Cartegraph – to track and report on building energy performance. Cartegraph can be coded to present the information in an energy management style dashboard. This is likely to require some coordination with Reliable Controls, a third-party energy management company, as the City uses their services for approximately 20 buildings and facilities. It is also recommended that energy dashboards be incorporated into key City buildings and displayed prominently where people congregate on a regular basis (e.g. City Hall).

To monitor assets accurately, the City will have to address issues around shared utility meters, the separate management of three fleet groups (fleet, police, and fire), and how it defines small and large equipment. To better understand facility energy and GHG performance, the City will need to strategically consider the use of sub-meters at high energy consuming locations. As it relates to fleet and equipment performance, it is recommended that the City track all fleet and equipment assets in the City's asset management system (this includes fire and police fleet) as well as fuel consumption.

## Summary of Proposed Initiatives

A summary of the proposed initiatives is presented in the following table.

### Table 9. Summary of Building & Facility Initiatives

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| B1: Corporate Energy Specialist | Make Corporate Energy Specialist Position full time position with responsibilities to support CEEMP Building and Facilities initiatives implementation. | Supportive Initiative | Supportive Initiative | 2022 | Facilities<br>Human Resources<br>Climate Action Program |
| B2: Sustainable Buildings Policy & Technical Standards | Update Green Building Policy to require that all newly constructed and deeply renovated buildings meet a minimum of Step Code Level 3 and be Net Zero Ready and require an evaluation of alternative energy sources for new construction and major renovations. | Supportive Initiative | Supportive Initiative | 2022 | Climate Action Program |
| B3: Energy Projects | Implement the following energy projects:<br>• City Hall: LED conversion & lighting control installation<br>• Public Works Facilities: LED conversion and auto shut off<br>• Community Centre Energy Improvements: LED conversions, hot water tank replacements (gas to electric, where feasible)<br>• Victoria Police Department: LED conversion and lighting control installation | ~16,000 MWh | ~900 $tCO_2e$ | 2023 | Facilities<br>Climate Action Program |

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| | • Beacon Hill Park Administration Building and Greenhouses: LED Conversions, hot water tank replacements (gas to electric)<br>• Potting Shed - Furnace to baseboards<br>• Royal Athletic Park boiler fluid replacement | | | | |
| B4: Building Decarbonization Plans | B4a: Building Renewals - Deep Energy Retrofits. Develop building decarbonization plans for large energy consuming and GHG emitting buildings and facilities, and compete deep energy retrofits at:<br>• Crystal Garden<br>• City Hall<br>• Parks Works Yard<br>• Beacon Hill Admin<br>Operate all buildings on RNG. | ~14,500 MWh | ~9,500 $tCO_2e$ | 2030 | Facilities |
| | Decommission the Asphalt Plant | ~15,000 MWh | ~3,000 $tCO_2e$ | 2030 | Facilities |
| | Replace the following facilities with new facilities:<br>• Crystal Pool<br>• Fire Hall #1 (assumes all natural gas consumption is RNG) | ~7,000 MWh | ~6,000 $tCO_2e$ | 2030 | Facilities |
| B5: Ongoing-Commissioning Program | Prepare and implement an ongoing-commissioning plan. | ~13,000 MWh | ~600 $tCO_2e$ | 2023 | Facilities |

**CITY OF VICTORIA**

Buildings & Facilities

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| B6: Energy Performance Monitoring | Use Cartegraph to track and report on building energy performance monitoring and provide users with energy and GHG dashboards. | Supportive Initiative | Supportive Initiative | 2022 | Asset Management |

# 4.0 FLEET & EQUIPMENT

The City owns over 400 light-, medium-, and heavy-duty vehicles that are operated by City departments: Fire, Police, Operations, Roads, Underground, Transportation, Engineering, Planning, Administration, among others. The City also owns and operates over 800 pieces of small and large equipment. Fleet and equipment are powered variously by gasoline, diesel, compressed natural gas (CNG) and electricity which accounted for 27 percent of the City's energy use and 47 percent of GHG emissions in 2019. These GHG emissions are the direct result of the City providing a range of services to the community – for example, 27 percent of these GHG emissions come from Fire and Police Services (Table 10).

**Table 10. 2019 Energy & GHG Emissions By Departmental Grouping**

| Fleet Type | Energy (kWh) | Percent (%) | GHG Emissions ($tCO_2e$) | Percent (%) |
|---|---|---|---|---|
| Parks Fleet - Facilities Division | 53,409 | 1% | 12 | 1% |
| Parks Fleet - Parks Division | 220,526 | 2% | 52 | 2% |
| Parks Equipment | 384,732 | 4% | 91 | 4% |
| Public Works Fleet | 4,877,497 | 50% | 1,112 | 50% |
| Engineering Fleet | 21,685 | 0% | 5 | 0% |
| General Equipment | 1,408,523 | 14% | 321 | 15% |
| Fire Protection Fleet | 512,385 | 5% | 121 | 5% |
| Police Fleet | 2,181,243 | 22% | 481 | 22% |
| Other Fleet | 75,184 | 1% | 17 | 1% |
| **Total** | **9,735,185** | **100%** | **2,211** | **100%** |

No single measure – such as the procurement of electric vehicles - can reduce fleet and equipment's GHG emissions to meet the CLPs 2025 equipment and 2040 goal for fleet. Rather, a suite of strategies and actions contained within a Green Fleet Plan will be required to set the City on a path towards more aggressive fuel switching and GHG reduction initiatives which include:

- F1: Retaining Additional Fleet Subject Matter Experts
- F2: Developing Green Fleet Plan
    - F2a: Telematics Data Analysis
    - F2b: Fleet & Equipment Life Cycle Analysis
    - F2c: Green Fleet Plan

- F3: Establishing a Corporate Electric Vehicle Pool
- F4: Piloting New Technologies

Compared to the 2007 base year, fleet, and equipment GHG emissions are expected to continue to rise as result of increased staff and as the community grows but will be offset as a result of Provincial and Federal Vehicle Fuel Efficiency Standards. Figure 15 illustrates the progression of GHG emissions reductions over time compared to those forecasted in the business as usual scenario.

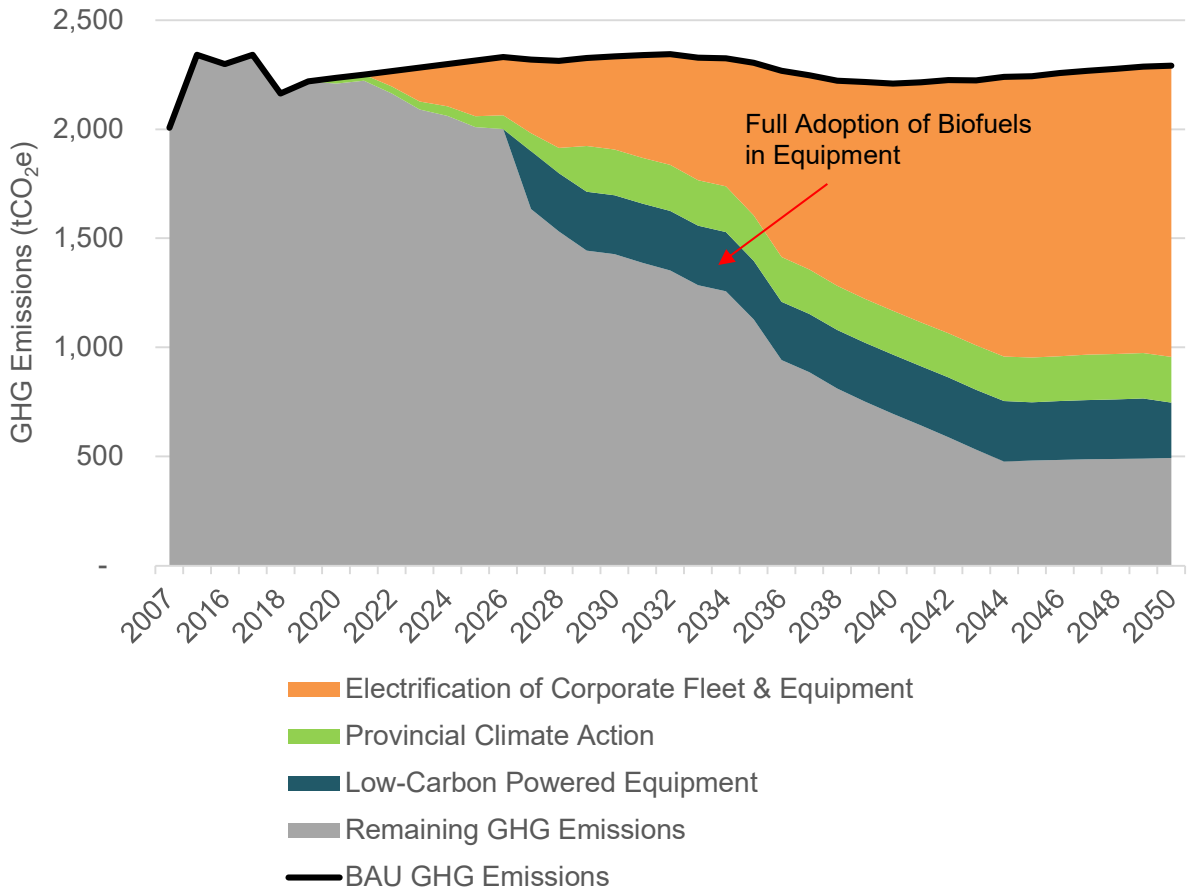


**Figure 15. Forecast of Fleet & Equipment GHG Emissions**

It is estimated that fleet can reduce its GHG emissions by 41 percent by 2030 and 84 percent by 2050 (Table 11).

### Table 11. Estimated GHG Emission Reductions From Fleet & Equipment

| Year Ended | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| Fleet Emissions Reductions ($tCO_2e$) | 404 | 706 | 1,300 | 1,534 |
| Equipment Emissions Reductions ($tCO_2e$) | - | 427 | 376 | 381 |
| Remaining GHG Emissions ($tCO_2e$) | 1,900 | 1,186 | 490 | 321 |
| Change from 2007 Base Year | -5% | -41% | -76% | -84% |

*Notes to table: 2007 Base Year = 2,007 $tCO_2e$*

Both the previous table and figure show that it will be difficult for the City to quickly and significantly reduce or offset GHG emissions by 2030 due to a range of factors both within and outside of the City's control.

External factors include a limited number of available low- or no-emission heavy duty vehicle and equipment options currently available for purchase, and many of those that are available do not meet occupational health and safety requirements (for example, electric leaf blowers that cannot be used in the rain, Fire requires the use of specialized equipment that is not available in battery electric versions). In light of the City piloting and adopting the use of electric equipment where possible, the City will need to utilize biodiesel (meeting the requirements of CAN/CGSB-3.524 for Blending in Middle Distillate Fuels) in equipment to achieve its CLP target of converting all small equipment to 100% renewable fuels by 2025 and to support the achievement of the 2030 GHG reduction target. Accessing a supply of B100 or R100, however, may also be an issue in the next 5 years, but with increased demand from other cities, like Vancouver, post-2025, supply is not likely to be an issue.

Internally, there exists several barriers to fleet and equipment optimization which include a culture of perceived vehicle ownership by drivers, a lack of accountability and guidelines around non-essential vehicle use, limited measurement systems in place to track asset performance and associated life cycle costs (e.g. equipment being sold at half-life, some vehicles being driven 600km per year, etc.), limited on-site fuel tracking and accountability systems (e.g. one fuel card is often used to fill up multiple vehicles and equipment), and a lack of capital funding and available resources. With respect to transition to electric vehicles (EV), the Fleet division currently does not have the capital budget available to maintain the existing fleet by replacing like-for-like vehicles. With a current and forecasted capital shortfall, the Fleet department cannot internalize the premium for EVs even with Provincial and Federal EV rebate incentive programs in place. It should also be noted that the City's capability to replace emergency vehicles or heavy-duty vehicles with zero emission vehicles will rely upon the advancement of EV technology and enabling legislation. The City also faces dedicated parking for charging space issues, and a lack of available power distribution that will need to also be addressed before the City fleet can aggressively convert its light duty fleet to electric.

# FLEET & EQUIPMENT CEEMP INITIATIVES

To achieve the 2030 GHG reduction target, after accounting for the building and facilities actions, the City must aggressively electrify fleet and convert all equipment to electric or renewable fuels. Achievement of the 2050 target will involve converting all emergency and non-emergency light duty vehicles, trucks, and heavy-duty equipment to electric or renewable fuels.

While many non-essential service vehicles can soon be replaced with electric vehicles that are available on the market, the City's capability to replace emergency vehicles or heavy-duty vehicles with zero emission vehicles will rely upon the advancement of electric vehicle technology and enabling legislation. To meet the CLP targets, it is anticipated that some fuel switching to biofuels will be required at least to reach the 2030 target. R100 is a biofuel replacement for diesel that requires no vehicle modifications and is a strong candidate for City heavy duty vehicles GHG emissions reduction. High ethanol content gasoline can reduce the GHG emission of gasoline vehicles when no electric alternative is available in the short-term, e.g. police patrol vehicles.

## F1: Fleet Subject Matter Experts

In 2019, the City implemented a vehicle telematics project which generates data that can be used to address several fleet and fuel management challenges. Using fleet telematics data and route optimization, the City can optimize and reduce fleet size, maximize vehicle use, and adjust fleet composition which will result in reduced fuel consumption and GHG emissions. To utilize this new information, expertise is required to generate reports and build detailed strategies. It should be noted that irrespective of how many resources are put in place to implement the proposed initiatives, success will be largely based on what oversight systems and accountability systems the City puts in place (e.g. implementation of a driver accountability reporting system, assignment of GHG emissions to end users) to change the current culture.

## F2: Green Fleet Plan

The CLP requires that all small equipment operates on 100% renewable fuels by 2025, and 80% of the City's fleet is electrified or renewably powered by 2040. Converting these targets into action requires the use of the telematics data and the implementation of a Green Fleet Plan that establishes the systems and processes to address the barriers and challenges noted and convert the fleet to operate on no to low-carbon fuels.

### F2a: Telematics Data Analysis

The Green Fleet Plan will need to rely heavily on the fleet telematics data so that the City can optimize and reduce fleet size, maximize vehicle use, and adjust fleet composition which will result in reduced fuel consumption and GHG emissions. Using the telematics data, the City can evaluate vehicle routes to see if they are optimal in terms of fuel and driver time efficiency and consider other technologies or opportunities to reduce travel. The telematics data can also inform the process of assigning vehicles

based on identified need rather than driver preference. As such, the City should first process and analyze the telematics data prior to or as part of the development of the Master Plan and fleet specific targets.

**F2b: Fleet & Equipment Life Cycle Analysis**

To sustainably manage and replace fleet and equipment with the objective of reducing GHG emissions and transitioning to renewable fuels, an effective fleet replacement program that embodies life cycle cost is required. Meeting this objective requires establishing a life cycle replacement costing program that identifies when vehicle and equipment assets should be replaced to minimize the total cost of ownership to the City. Specifically, when a vehicle or equipment ages, its capital cost decreases as result of depreciation, and its operating costs increase. The sum of these two costs represents the life cycle cost of the asset, and ideally, the vehicle or equipment asset should be replaced when the annual operating costs begin to outweigh the decline in annual capital costs (Figure 16). When the cost of carbon is factored into lifecycle analysis it can accelerate the timing to which high GHG emitting assets are replaced. Without accounting for the cost of carbon and GHG emissions, City vehicles and equipment could be replaced too late, resulting in increased operating and fuel costs and ultimately, higher energy and GHG emissions.

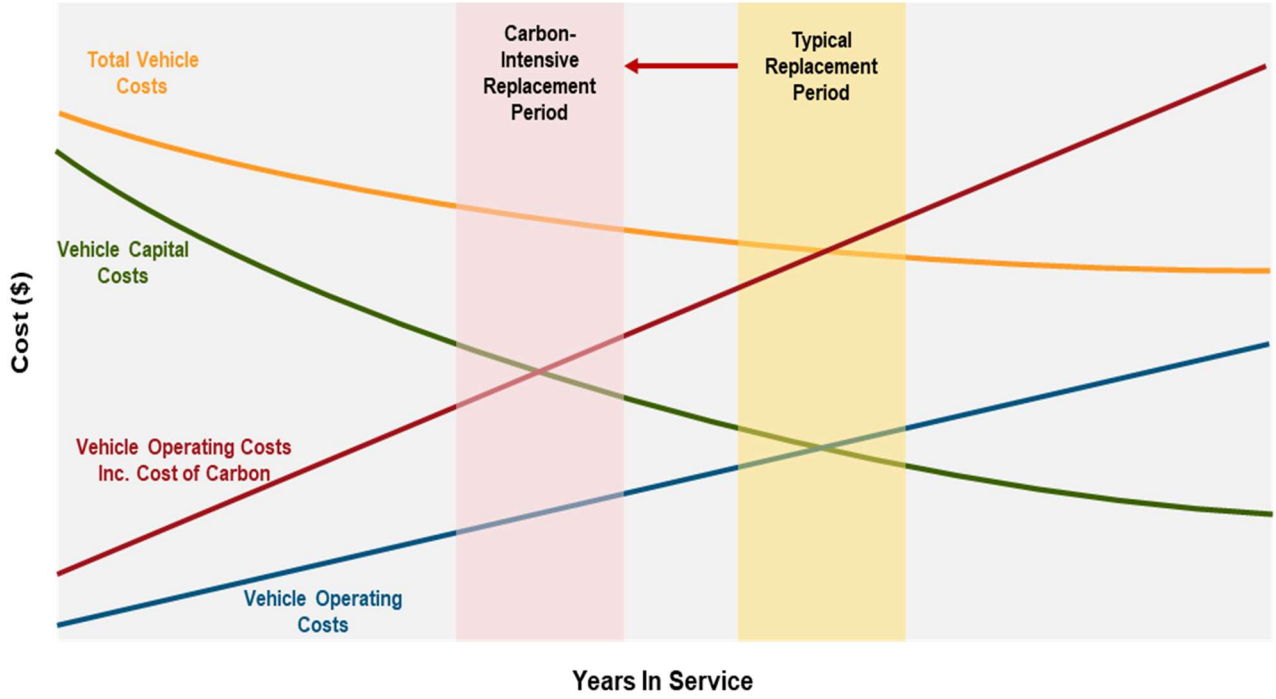


**Figure 16. Vehicle Lifecycle Cost And Optimum Replacement Timing With and Without Cost of Carbon**

It is recommended that Fleet work with Finance to develop a vehicle and equipment life cycle replacement and cost assignment program that utilizes an internal cost of carbon. This would require the City to update the hourly rate/cost of vehicles which would then be used to assign to user departments.

**F2c: Green Fleet Plan**

It is recommended that the Plan focus on initiatives that aim to reduce the size of the City's fleet, reduce kilometers travelled, use vehicles more efficiently, standardize the vehicle fleet where possible, track life-cycle vehicle costs, and accelerate fuel switching.

At a minimum, the Green Fleet Plan must:

- Review the current fleet utilization rates and life cycle costs and establish a pathway to reduce fleet size by at least 10%.
- Determine a process to use of an internal cost of carbon and life cycle assessments to reduce, replace or re-assign vehicles and equipment.
- Determine a process that incorporates vehicle right-sizing requirements to identify which vehicles can be replaced with electric or low-carbon fuel powered alternatives.
- Contain a strategy towards converting all equipment to run on low- or no-carbon fuels before 2030.
- Include electric vehicle charging infrastructure, or at a minimum, rough ins during construction to support future vehicle charging infrastructure (electric vehicle ready) as part of the City's buildings technical standards.
- Establish a plan to install electric vehicle infrastructure that:
  - Serves daytime public and non-fleet charging and nighttime fleet charging (where feasible).
  - Identifies priority locations and opportunities to develop integrated multimodal mobility hubs that include electric vehicle infrastructure on City property.
  - Identifies suitable locations for cost-effective charging to allow for a range of vehicle types and charges.
  - Identifies priority areas for the co-location of electric vehicle infrastructure that supports both light-duty and heavy-duty vehicles.
  - Identifies opportunities to upgrade charging infrastructure at City properties to allow for sub-metering of charging activity, improve remote management capabilities, and increase charging options.
  - Includes a system to monitor billing and electricity use for the electric vehicle fleet to allow for tracking, allocating, and reporting of costs and benefits.
  - Includes a phased approach to address increased charging access (e.g. encourage other types of electric vehicles, encourage at-home charging when feasible, etc.).
  - Identifies staff resources required to implement Green Fleet Plan recommendations

- Include policies that afford the Fleet division with the ability to allocate vehicles for staff based on the functional needs required with the goal of rationalizing fleet assets, reducing fuel consumption, and increasing fleet efficiencies.

## F3: Corporate Electric Vehicle Pool

There is an opportunity for the City to develop a corporate vehicle pool, where there is a central pool of shared vehicles used to increase overall efficiency as staff can take more trips, receive better mileage, and serve more drivers per day than assigned vehicles, and reduce GHG emissions. The supporting infrastructure (i.e., online vehicle booking system, electric charging stations, parking) would need to be put in place at staff hub locations like City Hall and Public Works where staff can be assigned to implement and manage booking system. If there is not an adequate pool available, the City should explore using a car sharing providers like Modo as part of the program. With a third party, the City avoids incurring capital and maintenance costs and can access an established tracking and reporting system. The drawback of using a third provider is the cost to use the system and the availability of vehicles. At a minimum, a pilot project should be explored with the CRD as a means to share operational costs.

## F4: Pilot New Technologies

The City has been actively piloting new technologies as part of reducing fleet and equipment fuel consumption and GHG emissions. Success of this initiative is evidenced by the fact that 13 percent of equipment is already electric. The City should use this experience to develop a formal strategy to transition small mobile equipment (e.g., mowers and leaf blowers) to electric or zero emissions technologies. It is also recommended that the City continue to investigate pilot projects utilizing electric vehicle and other heavy truck hybrid technologies as they become available and recommend unique opportunities which result in cost effective and reduced fuel consumption and GHG emissions. For instance, the City may wish to pilot vehicle radio-frequency identification (RFID) technologies that would be used to identify equipment and append the details of each fueling transaction to a unique piece of equipment (e.g., passive vehicle fuel rings and wireless nozzle readers). This measure would address the current fuel tracking and assignment challenges noted previously.

## F5: Develop a Fleet Electrification Financing Strategy

The corporate fleet is currently capitalized to support the replacement of vehicles on a like for like basis and add new vehicles to the fleet as directed by Council based on growth and development of corporate services. This strategy does not support a transition to an electrified fleet. Significant barriers include the high capital cost of an EV compared to a combustion engine vehicle. Some of the high capital cost can be recouped in savings made from reduced fuel and maintenance costs and from provincial rebates on EV purchases., but additional support is needed , at least in the short and medium term, to support the transition to an electrified fleet and to meet the 2030 CLP target. The following three strategies are recommended:

4.0 Fleet & Equipment

1. Apply an internal cost of carbon of $150/tonne by 2022. There is Council direction through the CLP to implement a shadow carbon price. This recommendation will be to make this an actual cost for fleet users and apply it to Business Unit fleet charges in 2022.

2. Fleet Electrification Levy: Vehicle replacement cost charges are levied to Business Units and transferred to the fleet reserve. Business Units choosing to purchase ICE vehicles will pay a percentage premium over retail value to fund fleet electrification, 10% in 2022, 15% in 2023 and 20% in 2024 is proposed.

3. Fleet Vehicle Electrification Fund: To avoid impacting the budgets of BUs with high fleet demands, $X will be transferred to the Fleet budget in 2023, and increase by Y% each year to support fleet electrification an ensure it is on a path to meet the 2040 target by 2025

With these measures in place, the City will have built up a reserve sufficient to begin vehicle electrification in 2025 at a rate consistent with meeting the 2030 CLP target.

## Summary of Proposed Initiatives

A summary of the proposed initiatives is presented in the following table.

### Table 12. Summary of Fleet Initiatives

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| F1: Fleet Resources | Hire a consultant to develop a Green Fleet Plan and review resource implementation requirements. | Supportive Initiative | Supportive Initiative | 2022 | Facilities<br>Human Resources |
| F2: Green Fleet Plan | F2a: Telematics Data Analysis: Process fleet telematics data to inform the development of the Green Fleet Plan. | Unknown (5-10%) | Unknown (5-10%) | 2023 | Fleet |
| | F2b: Fleet & Equipment Life Cycle Analysis: Develop a vehicle and equipment life cycle replacement and cost assignment program that feeds into the City's asset management and financial systems. | Supportive Initiative | Supportive Initiative | 2023 | Fleet<br>Finance<br>Asset Management |
| | F2c: Green Fleet Plan: Develop and implement a Fleet Management Plan and associated polices that sets out pathway towards reducing fleet and equipment, increases utilization efficiencies, and aggressively converts all fleet and equipment to low- or no-carbon fuels. | ~64,000 MWh | ~26,000 $tCO_2e$ | 2024 | Fleet<br>Finance<br>Asset Management |
| F3: Corporate Electric Vehicle Pool | Develop a corporate EV pool with supporting infrastructure (i.e., online vehicle booking system, prioritized parking, etc.). This would require realignment of the incumbent fleet of | Supportive Initiative | Supportive Initiative | 2021 | Fleet<br>Climate Action Program |

4.0 Fleet & Equipment

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| | EVs to a more generic bookable fleet. No additional vehicles are required. | | | | |
| F4: Pilot New Technologies | Continue to use pilot projects utilizing biofuel and electric-powered heavy-duty truck technologies as they become available. | Unknown | Unknown | Ongoing | Fleet |
| F5: Develop a Fleet Electrification Financing Strategy | Develop a three-tiered approach to finance investment in fleet electrification using an internal cost of carbon, a levy and vehicle electrification fund. | Supportive Initiative | Supportive Initiative | 2021 | Fleet Finance |

# 4.0 INFRASTRUCTURE MODERNIZATION

Cities are centers of communication, commerce, and culture. They are also responsible for more than 70% of global energy related GHG emissions, and therefore, represent the single greatest opportunity for tackling climate change. Many of these GHG emissions are the direct result of how cities are built - i.e. carbon emissions embedded in construction materials and the efficiency of operational systems. As infrastructure is renewed and replaced, there exists opportunities to reduce actual and embodied GHG emissions, create new economic opportunities, and increase the resilience of social infrastructure and natural capital including green space, urban trees, watersheds, and public parks. The following proposed initiatives are aligned with the CLP's goal to reduce GHG emissions and minimize climate-related risks to city infrastructure through early planning and action.

## INFRASTRUCTURE MODERNIZATION CEEMP INITIATIVES

### I1: Sustainable Infrastructure Rating System

Numerous infrastructure sustainable rating systems are available to facilitate and assess sustainable practices throughout the various phases of a project's life cycle. Many of these systems, like GreenRoads and CEEQUAL/ BREEAM, are infrastructure type specific (transportation, water, and roads) and do not always assess the holistic nature and impacts of a project. Envision, developed by the Institute for Sustainable Infrastructure (ISI), is a comprehensive rating system that assesses not only individual project performance, but also how the project contributes to the sustainability of the community it is situated within. Envision includes 5 main categories: Quality of Life, Leadership, Resource Allocation, Natural World and Climate and Risk. The rating system seeks to address two questions: is this the right project and is the approach right. The Envision ISI Framework has several credits specific to the CEEMP objectives including requirements to reduce embodied, construction and operational GHG emissions and energy usage over a project's life cycle. It is recommended that the City investigate a policy that requires all infrastructure capital projects over $100,000 be assessed, but not registered or verified, under the Envision ISI Framework.

Use of the Envision ISI Framework does not require staff credentialling (the cost is $250 USD for local government staff), and training in the program via online videos takes upwards of 8 hours. There are no membership fees for local governments.

### I2: Life Cycle Emissions

Like most local governments, the City is often juggling and prioritizing competing financial priorities, which can result in a procurement culture where the lowest bid is often seen as the most viable and best value for taxpayers. The result, however, is a system that defaults to 'like-for-like' replacements, penalizes higher cost energy and GHG emission reduction technologies and best-practices, and does not account for the GHG footprint of the products or services being provided. For example, NRCAN estimates that 20% of Canada's GHG emissions are embodied in the construction sector – which are not accounted for

in most municipal GHG accounting systems.[7] To shift the current City culture and narrative, it is recommended that the City integrate LCA processes into budget and capital planning, strategic planning, purchasing policies, preventative maintenance plans, environmental management plans, and asset management. It is also recommended life cycle energy and GHG emissions reduction measures be incorporated as part of the rationale for budget requests, that these measures feed into the annual budgeting process, and that projects be examined in consideration to the total life cycle of the asset. Life cycle emissions are also an important consider in the development of decarbonization plans. For example, electric heat pumps often operate using refrigerants, many of which have high global warming potential (GWP). An LCA as part of a building decarbonization plan would examine refrigerant GWPs before deciding on final recommendations.

Success means that these measures are incorporated into the initial stages of operational and capital project planning, and that options for energy efficiency and conservation are considered, evaluated, and quantified in terms of life cycle, which includes cost, maintenance, and energy and GHG reductions. This action will require a study to develop LCA criteria for different infrastructure types, assess which LCA tools (e.g., RETScreen) could meet the City's needs, the development of technical guidance, and LCA training for City staff.

## I3: Reduce Infrastructure Energy Consumption

In addition to building and fleet, the City also operates streetlights, traffic signals, underground infrastructure, and an asphalt plant all of which consume energy and produce GHG emissions. With their typically low emissions profile, these assets tend to get overlooked, and opportunities lost that can lead to missed operational savings. For example, streetlights consume a large amount of energy, but since they are powered by electricity, they have a low GHG emissions profile. It is recommended that the City complete energy efficiency reviews on non-building and fleet infrastructure, examining systems as a whole as well as reviewing individual components for efficiency opportunities.

## I4: Alternative Energy Sources for Stationary Assets

There is an opportunity to implement alternative energy systems – such as solar photovoltaic (PV) systems - on some of the City's building and other stationary assets, which include transit shelters, buildings, and parking lots. It is recommended that the City explore such opportunities as they arise.

The projected economic costs are expected to be disproportionately high for the relatively lower GHG emissions even with an internal cost of carbon of $150/t$CO_2$e because this initiative would replace hydro-based grid generated electricity in BC. In light of this, such an initiative may be one method to address the electricity distribution barrier for EVs – i.e. a solar PV array could be used to power City EV fleet. Alternative energy projects also reduce dependency on grid power and support grid energy conservation targets.

[7] https://www.nrcan.gc.ca/energy-and-greenhouse-gas-emissions-ghgs/20063

## Summary of Proposed Initiatives

A summary of the proposed initiatives is presented in the following table.

### Table 13. Summary of Infrastructure Initiatives

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| I1: Sustainable Infrastructure Rating System | Investigate a policy that requires all corporate infrastructure or building / facility capital projects over $100,000 be assessed under the Envision ISI Framework | Supportive Initiative | Supportive Initiative | 2025 | Operations |
| I2: Life Cycle Considerations | Integrate LCA processes into budget and capital planning, strategic planning, purchasing policies, preventative maintenance plans, environmental management plans, and asset management. | Supportive Initiative | Supportive Initiative | 2022 | Operations<br>Finance<br>Procurement |
| I3: Reduce Infrastructure Energy Consumption | Complete energy efficiency reviews on non-building and fleet infrastructure, examining systems as a whole as well as reviewing individual components for efficiency opportunities. | Unknown (5-10%) | Unknown (<1%) | Continuing | Facilities Operations |
| I4: Alternative Energy Sources | Install renewable energy systems, where there is a business case, or the implementation supports CLP guiding principles of leadership, providing to access to renewable fuels | Unknown | Unknown | Ongoing | Climate Action Program |

# 5.0 CORPORATE LEADERSHIP

The City has both a responsibility and an opportunity to respond to the causes and impacts of climate change and it has recognized this by committing to an 80 percent reduction in GHG emissions and a shift from GHG-intensive fossil fuels to 100 percent renewable energy. As part of the CLP, the City committed to reducing corporate annual GHG emissions, minimizing climate-related risks to City, and developing processes so that all actions are informed by a full understanding of through-life social, environmental, and economic costs, risks, and benefits. Understanding the full suite of sustainability risks and benefits for each asset and service area allows the City to make smart investments to reduce GHGs as much as possible for every dollar invested. The following proposed initiatives align with these commitments and set the foundations for other initiatives identified in the CEEMP.

## CORPORATE LEADERSHIP CEEMP INITIATIVES

### L1: Internal Cost of Carbon (ICC)

Climate change impacts are expected to have serious negative effects on global economic growth and development. In 2005, the UK government commissioned an independent economic review called The Stern Review, which concluded, "the benefits of strong and early action far outweigh the economic costs of not acting."[8] Using results from economic models, the Review estimated that if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global Gross Domestic Product (GDP) annually – potentially as much as 20% of GDP. In contrast, the costs of implementing actions to reduce GHG emissions and mitigate the impacts of climate change could be limited to around 1% of global GDP annually.

Although the social and environmental benefits of reducing energy and GHG emissions are well established, their recognition or importance in decision making processes are often under-represented. Applying an internal cost of carbon (ICC) allows organizations to better account for these benefits and is a key component to moving an organization towards its energy and GHG reduction targets. To support many of the proposed initiatives in the CEEMP, it is recommended that the City establish an ICC which would be used to calculate the value (expressed as a cost) of GHG emissions associated with decision-making in respect to all City assets and infrastructure. ICCs are also know as shadow carbon prices.

It is recommended that the City align its policy with the City of Vancouver which establishes the ICC at $\$150/tCO_2e$ in 2019. The ICC will then escalate at the same rate as BC's carbon tax until 2021, after which it will escalate at 6% per year. For context, the City can purchase fossil natural gas from FortisBC for $3 per gigajoule (GJ), while renewable natural gas costs $9 per GJ. Factoring in an ICC would shift the FortisBC cost to $10 per GJ and support the business case for renewables.

[8] Nicholas Stern. *The Economics of Climate Change: The Stern Review*. Cambridge University Press, January 2007. http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

## L2: Modify Climate Action Reserve Fund Policy

The City has an informal policy that takes actual utility savings in terms of available budget and assigns the remaining budget to a special projects account (e.g. realized utility savings from an LED retrofit program would be assigned to a financial account for use in the future). It is recommended that the City formalize this policy and require that the energy efficiency savings be channeled to the Climate Action Reserve Fund (CARF).

Wherever possible, the City should take advantage of external funding opportunities to supplement the CARF and speed up the implementation of project initiatives. For example, the City could submit an application to Infrastructure Canada for federal funding under the Community, Culture and Recreation Fund to support the decarbonization plans which would reduce GHG emissions and increase climate resilience. This would address some of the City's adaptation actions and support the climate change mitigation and adaption funding requirements set out by Infrastructure Canada.

As these programs are subject to political changes, the City should proactively plan and incorporate capital and operating costs of the proposed initiatives into future budgets. This will enable the City to take advantage of external funding opportunities when they are available, but not have to rely on these external sources to move forward on initiatives.

## L3: Employee Transportation Demand Program

A cost-effective energy and GHG reduction program implements policies that allow for more flexible work environments and dis-incentivizes travel. In light of the impacts of COVID-19, the City has adopted several strategies to protect employee health and safety that also reduce energy and GHG emissions from operations. These strategies include:

- **Alternative work schedules** which allows employees to vary their hours from day to day or compress more working hours into fewer days.
- **Telecommuting** which enables employees to work from home offices or other alternative spaces.
- **Shared offices and hoteling**: This strategy provides a flexible work environment that allows for better space utilization, in that employees do not have a dedicated office space and use a space that is available and can have a significant reduction on greenhouse gas emissions as the strategy can enable the City to avoid adding additional buildings to accommodate a growing staff population.
- **Virtual meeting rooms and teleconferencing**: The City uses Microsoft Teams to facilitate virtual and in-person meetings which create the same experience for the user as face-to-face meetings.

Post-COVID-19, it is recommended that the City continue to deploy these strategies as a means to reduce travel related costs (both staff time and reimbursement of fees) and GHG emissions. It is further recommended that the City expand the use of the air travel carbon tax, which requires City staff to estimate their GHG emissions from air travel and internalize the cost of the associated GHG emissions in their budget, to all forms of business travel.

## L4: Environmental Procurement Program

The City has supported the purchase of environmentally friendly products and services in principle, but currently does not have a formalized environmental procurement program. Such a program can help reduce energy use and GHG emissions that result from operations, contracted services, and in the construction of City infrastructure. The objective of an environmental procurement program is to shift spending away from goods and capital assets that have a greater energy, GHG, water, waste footprint towards those that have a smaller footprint over the goods or services lifespan.

The interest in green procurement reflects growing market preference for environmentally superior goods and capital assets referencing environmental, sustainability and corporate social responsibility standards. However, identifying and verifying the relative environmental benefits of products and establishing which products are actually “green” or “greener” is challenging. There is a general lack of industry standards and accepted criteria for valuation. Many factors throughout the entire life cycle of the product and packaging supply chain, use, and disposal can be included and if so, weighted in analysis. Environmental aspects include items such as recycled content, renewable versus non-renewable resource inputs, greenhouse gas emissions and embodied energy, other contaminant emissions, energy efficiency, and waste production and reduction. Economic, social, and cultural aspects of procurement include ethical and fair-trade practices such as economic and employee equity, worker health and safety, child labor, and community economic development.

To reduce energy and GHG emissions from products and services, it is recommended that the City develop a Sustainable Products Ranking Framework and associated program. A Sustainable Products Ranking Framework would enable the City to clearly assess the degree to which environmental and social considerations have been addressed over the life cycle of a good or capital asset. Such a framework is designed to compare, rank and weigh purchases based on set Regional requirements (e.g., cost, efficiency, etc.) as well as the degree to which the environmental and social impacts of concern have been reduced or eliminated. Each purchase would be assessed against a base case product or service for which no identifiable efforts have been made to reduce the environmental or social impacts. Such a framework, its requirements, criteria, and processes would need to be documented and reside in an Environmental Procurement Program Guide. In the case of capital goods, like buildings, the Framework would incorporate green performance requirements / objectives and performance metrics such as Energy Use Intensity (EUI) and/or Thermal Energy Demand Intensity and/or GHG Intensity and would undergo an energy and GHG emissions LCA to quantify the energy and GHG impact that would be incurred over the life of the asset. These performance targets would then be carried through into contractual requirements, along with associated penalties for non-compliance. To track and monitor contracted services, it is recommended that the City include energy and GHG emissions reporting requirements in all new and renewed contracts post 2022.

## L5: Departmental GHG Accounting & Reporting

Without coordination of investments that impact corporate consumption of fossil fuels across and within departments, there is a risk of making investments that lock-in GHG emissions such that the emissions target is missed or additional expenditure required to get back on track

The tracking of energy consumption and GHG emissions data from fuel and utility bills is valuable for departmental energy-related decision making and should be provided to department directors and managers to support energy conservation and demand management. It is recommended that Fire, Police, Parks, Recreation and Facilities and Engineering and Public Works departments develop a 5-year energy and GHG emissions reduction plan for their operational activities, and report on progress annually in Greenhouse Gas Emissions - Trends and Outlook section of the annual Financial Plan . This would enable each department to directly engage in the CEEMP by tracking the energy use and GHG emissions resulting from day to day operations, decision-making, and capital purchases.

## Summary of Proposed Initiatives

A summary of the proposed initiatives is presented in the following table.

### Table 14. Summary of Corporate Leadership Initiatives

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| L1: Internal Cost of Carbon (ICC) | Establish a policy that requires the use of an ICC of $150/tCO2e (expressed as a cost) in asset and infrastructure decisions such as vehicle procurement and building acquisition and modification. | Supportive Initiative | Supportive Initiative | 2021 | Operations |
| L2: Modify Climate Action Reserve Fund Policy | Modify existing energy savings policy to require that the energy efficiency savings be channeled to the Climate Action Reserve Fund (CARF) | Supportive Initiative | Supportive Initiative | 2021 | Climate Action Program |
| L3: Employee Transportation Demand Program | Continue to implement policies that allow for more flexible work environments and dis-incentivize travel. | Supportive Initiative | Supportive Initiative | Ongoing | Climate Action Program |
| L4: Environmental Procurement Program | Develop and implement a Sustainable Products Ranking Framework and Program that more clearly prioritizes products and services that reduces / | Supportive Initiative | Supportive Initiative | 2025 | Procurement |

| Initiative | Recommendation | Total Energy Reduction Potential: 2021-2050 | Total GHG Reduction Potential: 2021-2050 | Estimated Completion Year | Responsibility |
|---|---|---|---|---|---|
| | conserves operational energy use and GHG emissions. | | | | |
| L5: Departmental GHG Accounting & Reporting | Develop a methodology to assign energy consumption and GHG emissions to each department. | Supportive Initiative | Supportive Initiative | 2022 | Climate Action Program |

# 6.0 CEEMP MANAGEMENT SYSTEM

A management system is a tool to facilitate the continuous improvement of a plan. For the CEEMP, it ensures that there will be ongoing monitoring, management, and refinement over time. This will keep the CEEMP current and ensure it is a living document.

Management systems in general range from simple documents to elaborate IT systems. In the context of the CEEMP, the management system is simply a documented delineation of the processes, roles and responsibilities to ensure the CEEMP is implemented and its initiatives are actioned and progressed towards the CLP corporate targets. The key focus of a management system is its commitment to continuous improvement. Moving forward, the actions and monitoring requirements developed for the CEEMP will be regularly reassessed and refined.

It is recommended that the CEEMP should be updated every five years. The following management system framework focuses primarily on the five and ten-year planning horizon. Changes to federal and provincial legislation and regulations, as well as technological advances are anticipated over the next decade that will impact the adoption and implementation of longer-term initiatives. The following are the framework's core elements:

- Governance and Collaboration
- Energy / GHG Boundaries
- Data Collection
- Data Analysis
- Evaluating Future Initiatives
- Monitoring & Reporting
- Communication Strategy

## GOVERNANCE & COLLABORATION

The CEEMP is governed by a team of corporate stakeholders, called the CEEMP Steering Committee, with the mandate of ensuring that the CEEMP remains a priority within the City. The structure of the Committee enables for a more direct integration of energy and GHG emissions management in the City's systems while creating the necessary culture of change within the City. The CEEMP Steering Committee is supported by the CEEMP Advisory Group, who generate annual departmental carbon emissions reports and support the Departmental CEEMP teams. Departmental level initiatives are led by the Departmental CEEMP Teams who are also responsible for establishing carbon allocations across departmental business units (Parks, Recreation and Facilities, Fire, Police and Engineering and Public Works). The Departmental CEEMP Teams are also responsible for the implementation of annual CEEMP

actions to stay within set annual carbon allocations. Success of the CEEMP relies on ongoing collaboration and participation across departments and divisions. It is recommended a small technical group be created to support carbon budgeting and tracking of emissions related to City operations, a CEEMP Advisory Group (see Table 15). This group would support existing department teams working on City Carbon Allocations and other initiatives. It is further recommended a SLT Steering Committee be formed by those Directors whose departments are accountable for the bulk of corporate GHG emissions. Collectively these groups will be enabled to set departmental GHG emission reduction targets, deliver annual departmental emissions reports and manage departmental emissions.

The roles and responsibilities of the CEEMP organizational structure are presented in Table 15.

Table 15. CEEMP Roles & Responsibilities

CEEMP Accountability – Key Groups

| | Members | Roles and Responsibilities |
|---|---|---|
| Council | | Receives CEEMP annual reports and approves CEEMP budget items as part of annual Financial Plan |
| CEEMP Steering Commitee | Includes Senior Leadership from Finance, Parks & Facilities, Fire, Police and Engineering/PW Depts. | Based on CEEMP, sets annual departmental carbon allocations, reviews annual reports and approves CEEMP budget requests for insertion into draft Financial Plan. |
| CEEMP Advisory Group | Environmental Sustainability Coordinator and SMEs from Fleet, Facilities, Finance and Procurement | Generates annual departmental carbon emissions reports. Supports the Steering Committee and Departmental CEEMP teams implement carbon allocations. Supports CEEMP project prioritization. |
| Departmental CEEMP Teams | Departmental Managers and ADs, and their Finance team supports | Receives annual carbon budget, allocates carbon budget across departmental BUs for Parks & Facilities, Fire, Police and Engineering/PW. Generates and implements annual CEEMP project list in alignment with carbon budget. |

The CEEMP Steering Committee meets quarterly or as needed with the following objectives:

- Review annual corporate energy and emission trends and annual departmental emission reports.
- Based on CEEMP, sets annual departmental carbon allocations,
- Annually approves CEEMP overall work plan and budget requests for insertion into draft Financial Plan
- Provide information for the annual Corporate Energy and GHG Emissions Progress Report to Council.

As part the CEEMP, the implemented process improvements, program implementation and projects will continue to be documented and reviewed annually to update consumption savings. By regularly monitoring and reporting consumption and dollar savings and/or avoidance to each department. the outcomes of their participation in energy management initiatives can be demonstrated, and feedback can be obtained for any new ideas. Reporting on the overall corporate GHG inventory, progress towards CLP targets, and CEEMP initiatives will continue to be presented to Council through the annual Corporate Energy and GHG Emissions Report. Along with the preparation of an annual Corporate Energy and GHG Emissions Report, these activities will be rolled up into an annual CEEMP work plan, which will be reviewed with CEEMP Steering Committee and reported to Council.

The CEEMP should be updated every 5 years with the next update to occur in 2025.

# DEPARTMENTAL BUSINESS UNIT CARBON ALLOCATIONS

The Parks, Recreation & Facilities, Fire, Police, and Engineering & Public Works departments will be assigned carbon allocations, which will improve the likelihood that the City will achieve the CLP corporate targets. The CEEMP annual carbon allocations are presented in Table 16 below. Note, three-year groupings allow for carbon allocation flexibility between years. The CEEMP Steering Committee sets the upcoming year's carbon allocation as part of financial planning cycle.

### Table 16. Department Business Unit Carbon Allocations

| Department / Function | 2021-23 | 2024-26 | 2027-29 | 2030 | 2031-33 | 2034-36 | 2037-39 | 2040 | 2041-33 | 2044-46 | 2047-49 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parks, Recreation & Facilities | 2,622 | 2,497 | 1,817 | 131 | 385 | 380 | 371 | **123** | 367 | 368 | 369 | 123 |
| Public Works & Engineering | 4,707 | 3,854 | 2,664 | 707 | 1,850 | 1,304 | 941 | **307** | 922 | 914 | 919 | 288 |
| Fire | 549 | 426 | 422 | 119 | 364 | 374 | 384 | **130** | 396 | 405 | 414 | 140 |
| Police | 1,856 | 1,806 | 1,792 | 457 | 1,393 | 1,265 | 805 | **162** | 154 | 6 | 6 | 2 |
| Other Operations and Services, Finance, Planning, Etc. | 805 | 673 | 669 | 87 | 257 | 251 | 246 | **82** | 245 | 245 | 245 | 81 |
| **Total** | **10,539** | **9,256** | **7,363** | **1,501** | **4,249** | **3,573** | **2,747** | **803** | **2,085** | **1,939** | **1,953** | **634** |

# ANNUAL DATA COLLECTION & REPORTING

To reinforce the concept that energy is a variable cost and to make individuals accountable and empower them to control energy use, the City requires an effective data collection and monitoring system that integrates into existing City systems and provides accurate feedback.

Utility energy consumption data (from Fortis and BCHydro) is provided on a monthly or bimonthly basis and is automatically uploaded into SoFi - a third-party GHG accounting tool. Fleet and equipment fuel data is collected from several sources including Profuel, City General Ledger Accounts, and fuel suppliers, summarized in terms of total fuel volumes, and sent to the SoFi administrator for manual entry. At present, the SOFI model does not track fuel use by equipment or fleet type – and in many instances, nor does the City. Using the fuel volume data provided by the City and BC based emission factors, SoFi estimates the City's overall energy and GHG emissions.

In the short-term, it is recommended that the City continue using SoFi with the intent of using the system to report energy and GHG emissions at the department and City level. Also, in the short-term, it is recommended that the City work with Cartegraph to incorporate asset-level utility and fuel consumption datasets with the objective of integrating asset management and energy performance. Once the integration is successful – i.e. departmental SME's can track energy and GHG emissions internally by asset, the City can stop using the SoFi system. This will enable the City to monitor asset level energy variations, scale monitoring to the department and City operational level, and to support the energy and GHG reporting process (Figure 18).

# EVALUATING FUTURE INITIATIVES

The CEEMP contains a list of recommended initiatives to be completed over the 2019 - 2030 timeframe. Implementing the initiatives requires dedicated resources and systems in place to ensure that the policies, programs, and projects recommended are implemented and tracked so the City's CLP corporate operation targets are met. The intention of the CEEMP is to dovetail energy conservation, energy demand management, and GHG emissions as part of the City's normal course of business for asset retrofits, renewals, and life cycle replacement projects. Success in this endeavor requires incorporating conservation and demand management options at the initial design stages. In so doing, this ensures that options for improving energy efficiency are considered, evaluated, and quantified in terms of life cycle costing analysis, including cost, maintenance, GHG reductions and other co-benefits that may accrue to the City. When evaluating future initiatives, a City checklist should include the following:

- Project base case (i.e., what would happen without the implementation of the proposed project?)
- Energy efficient options
- Project costs (base case vs. energy efficient case)
- Project savings (in terms of energy, maintenance, avoided GHG emissions)

- Maintenance savings
- Financial benefits
- Environmental benefits
- Co-benefits
- Incentives/funding available
- Overall benefits
- Life cycle analysis recommendations

The CEEMP spans 10-years to which at that point, the initiatives will be evaluated in consultation with the various City departments, as part of the departmental strategic operations planning process. This will be an opportunity to review and prioritize potential strategies based on resources and emerging technological opportunities.

### Alignment with Other Plans

The CEEMP reflects the shared priorities of other City strategic documents such as the Climate Leadership Plan (2018), the Official Community Plan (2012) and recent climate related directions approved by Council – such as the travel policy on GHG emissions. Future updates to CEEMP should build on the most up to date versions of the above as well as other plans set to be developed in the next 12 months: the Green Buildings Plan, Zero Waste Plan, Climate Change Adaptation Plan, and the Public Works Master Plan. These updated plans should consider and, where applicable, align with the CEEMP. Annual reporting of the CEEMP is anticipated to be consolidated with reporting from other existing plans, such as the Climate Leadership Plan and the Financial Plan.

## MONITORING & REPORTING

An ongoing feedback loop, known as the Deming Cycle facilitates continuous improvement, can be used to enhance the CEEMP, and ensure that it remains as a living document that is maintained as a valued resource of the organization. Moving forward, making progress towards CLP targets, GHG emission forecasts, and the priority of the initiatives will be regularly reassessed and refined. The four components of the Deming Cycle, shown below in Figure 17 are “plan, do, check and act.” A run through the plan-do-check-act cycle must occur on an annual basis and should coincide with the City’s annual budget cycle for planning each year’s capital and operating budgets.

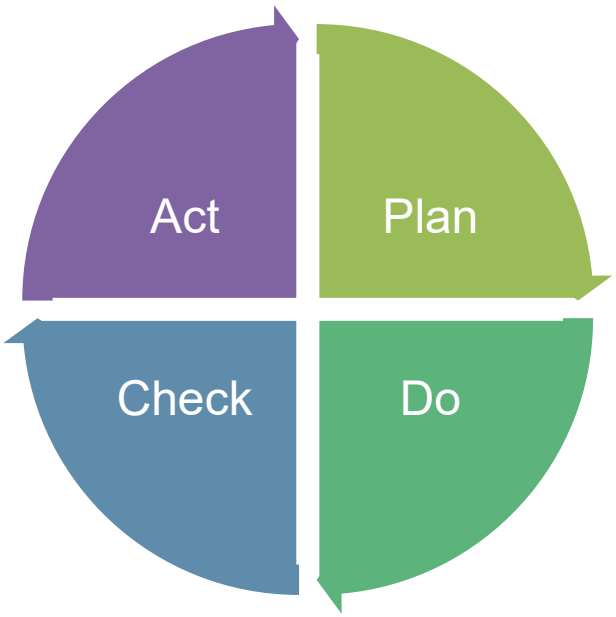


**Figure 17. The Deming Cycle (Plan-Do-Check-Act)**

A monitoring framework provides the City with a task list of items to track that will help re-assess the effectiveness of CEEMP initiatives, GHG emissions, and other activities contained within the CEEMP over time (the **"Check**" components of the cycle). Monitoring includes two components. The first is the monitoring of the CEEMP initiatives - what is being done, who is doing it, is the activity funded, etc. The second component is the compilation of the energy and GHG emissions inventory to monitor the success of the CEEMP initiatives. Tracking, measuring, and sharing progress towards the CLP targets and the initiatives identified in the CEEMP is essential to maintaining momentum for change. The success of the CEEMP will be measured by the results achieved relative to prior reporting years.

On an annual basis, the CEEMP Governance Committee will prepare a Corporate Energy and GHG Emissions Report, which at a minimum, will include:

- Current energy and GHG emissions profile in aggregate and broken down by department and/or division
- Change in energy and GHG emissions from the prior year and the baseline
- Follow up actions from the prior year's report.
- A description of the work that has been completed.
- Extent to which CLP targets have been met.

- Identification of any issues or challenges faced in advancing each initiative
- An indication of progress toward achieving each initiative, using the following scale:
    - Not Started – The initiative has not been implemented.
    - On Track – The initiative has been implemented.
    - Outstanding – An issue, barrier and/or challenge is prohibiting the initiative from being implemented.
    - Delayed – The initiative has been delayed or placed on hold.
    - Completed – The initiative has been completed.
- List of new initiatives to address issues, barriers, and challenges.
- Timing and assigned responsibilities of the initiatives.

For various initiatives, progress will be measured through quantitative and qualitative primary indicators and secondary indicators (Table 17).

### Table 17. CEEMP Key Performance Indicators

| Key Performance Indicator (KPI) | Measurement |
|---|---|
| **Building Energy Intensity** | Energy use per unit area |
| **Building Emissions Intensity** | Greenhouse gas emissions per unit area |
| **Building Energy Cost Intensity** | $ per unit area |
| **Fleet Fuel Efficiency** | Fuel quantity per kilometer |
| **Fleet Total Fuel Used** | Fuel quantity |
| **Fleet Number of Vehicles in Different Classes** | Number of vehicles with greater fuel efficiency, hybrid, electric vehicle etc. |
| **Streetlights** | Energy use per light |
| **Renewable Energy Generation** | Quantity of energy produced |
| **Renewable Energy Cost** | Total cost of renewable energy / Gigajoule |

The implementation of the Energy Conservation and Demand Management Plan (the “Plan and Do” components of the cycle) will require the formulation of an annual work plan to define what actions are undertaken annually. To aid in successful implementation, the annual work plan should tie into

departmental business plans and budgets to ensure responsibilities and resources are allocated accordingly. Progress will be reported to the following stakeholders as noted below.

# RESOURCE & BUDGET PLANNING

The City's 2019 energy expenditures including electricity, natural gas, diesel, gasoline, and propane was $2.4 million. It is anticipated over the next 10 years that the average cost of energy will increase by 2-3% per year, from which a large portion can be mitigated through the savings achieved by initiatives recommended in the CEEMP.

## CEEMP Financing

Financial support for the CEEMP is necessarily broad-based and aligns with the wide-ranging array of measures required to meet the Climate Leadership Plan (CLP) corporate GHG emissions reductions targets. Financing will be required in both capital and operating realms.

## Capital Costs

Delivering the CEEMP is based on replacement of infrastructure and equipment at the end of their useful life or when total cost of ownership is minimal. The implementation of the CEEMP will require investment in buildings, vehicles, and equipment over and above the norm of a like for like replacement. This level of investment will be necessary, at least initially, as the market for technologies that use renewable power sources is still developing. In recognition of the varying pace of market development, e.g. rapid development in building HVAC systems versus slow development in heavy duty fleet electrification, the CEEMP takes advantage of areas where technology is most advanced to leverage the greatest gains. The gap between base market technology and the renewably powered equivalent is projected to narrow as new building and vehicle standards become increasingly stringent in the latter half of this decade. The additional capital cost for transitioning corporate facilities to renewable power is not estimated. The upcoming Green Buildings Plan will outline capital investment requirements for facilities to meet the CEEMP targets. Transitioning the corporate fleet to renewable power will be described in the Green Fleet Plan and will provide clear direction on the appropriate level of financing necessary to transition the corporate fleet to renewable power. The Green Fleet Plan will be available in the second half of 2021. Transitioning small equipment is well underway and on track to be achievable at a modest incremental cost.

## Operating Costs

The CEEMP will impact operating costs in several areas both positively and negatively. Ongoing energy conservation work has yielded significant cost savings to the organization. Conversion of the City's streetlights is saving $250,000/yr. Additional energy conservation investments in City facilities that are underway are projected to save an additional $69,000/year or just over $2 million in total savings. In the corporate fleet, fuel switching to electric vehicles is anticipated to realize significant operating cost savings, as an electric vehicle typically requires less than a third the power of an equivalent internal combustion engine vehicle and requires substantially less maintenance resulting in substantial cost

savings. In buildings, fuel switching measures will also yield energy savings, however these do not always translate into cost savings as natural gas is available at about a third the cost of electricity. When electricity prices are compared with its renewable natural gas equivalent, the cost disparity is greatly reduced. It is estimated that switching from natural gas to renewable natural gas would cost the City an additional $300,000/year at 2021 prices. With BC Carbon Tax increases and improvements in renewable technologies, improved cost savings from fuel switching can be achieved.

Additional operating costs due to CEEMP will occur in several areas. The use of biofuels and renewable natural gas is required to reach the CEEMP 2030 target, these fuels are priced at a premium over their fossil fuel equivalents. Achieving the identified savings requires enhanced tracking of corporate energy consumption and expertise to implement the required measures.

The timing of efficiency upgrades and new projects as part of asset upgrades and renewal will continue to be brought forth to Council for approval within the designated budget year.

### Staff Resources

To reach the CEEMP targets, transformation of the City's fleet and facilities to renewable fuel sources is required. To meet the demands of this effort on fleet and facilities ongoing financial investment and two additional staff positions will be required. The CEEMP requires a full-time Corporate Energy Specialist to implement and monitor energy and GHG emissions in City buildings and it is anticipated a similar position will be required to oversee the transition of the City's vehicle fleet. Staffing for the two positions is estimated to require an additional $190,000/year.  Further, to ensure these transformations are fully enabled, changes are needed to established City operations and procedures. Through provision of a list of initiatives, the CEEMP describes where these changes need to take place, for example in asset management and procurement. Resources will be required to support these initiatives, either as one-time investments or on an ongoing basis. The CEEMP carbon allocation process, provides a framework for estimation and implementation of these initiatives by utilizing the expertise of managers and assistant directors and a mechanism to fund through the existing financial planning process.

Training facility staff on energy and GHG management practices and concepts builds competencies that enables staff to carry out operations more effectively and efficiently. The City should seek to include energy training concepts for relevant staff, where appropriate.

## COMMUNICATION STRATEGY

The overall goal of the communication strategy is to outline tools and techniques to assist the city with ongoing internal communication about the CEEMP, including implementation and progress towards targets. The communication strategy is focused on internal communication for city staff and council and is not designed to be public. The key objectives of the strategy are:

- To communicate the presence and importance of the CEEMP
- To share progress towards the CLP corporate targets

- To motivate multiple audiences about what they can do to reduce the City's energy use and GHG emissions.
- To communicate coming changes in business practices to support the ongoing implementation of the CEEMP

## Responsibility

Responsibility of the CEEMP implementation rests with the CEEMP Steering Committee and the Departmental CEEMP Teams through to delegation of actions to managers and staff.

## Tactics

The Communications Strategy includes a series of strategic tactics (Table 18).

### Table 18. Suggested Communication Tactics

| Tactic | Description/Rationale |
|---|---|
| Host quarterly CEEMP Steering Committee meetings | The intent of these meetings is to:<br>• Share best practices between departments<br>• Provide status/progress updates on Energy conservation and GHG emission reduction strategies across all departments<br>• Prioritize work<br>• Share funding opportunities<br>• Collaborate on shared initiatives that flow into annual work plans and budgets. |
| Develop an annual corporate Energy and GHG Emissions Progress Report | The CEEMP Advisory Group will gather information from all departments, and report annually on energy and GHG emissions.<br>Ensure the development of a one-page, graphic summary document which can be used to communicate results with a wide range of audiences. |
| Implement targeted energy skills training | Implement specialized training opportunities as per the CEEMP initiatives |
| Implement general energy skills training for all staff | Develop (or adopt) a stand-alone webinar that would be suitable for all City staff. The webinar could cover:<br>• The presence of the CEEMP<br>• The role of all staff members in contributing to energy conservation and GHG emission reductions |

| Tactic | Description/Rationale |
|---|---|
| | • Easy tips and reminders for every day corporate energy conservation and GHG emission reductions |
| Work to integrate key messaging into existing communications | Work alongside Corporate Communications to share tips and reminders about energy conservation and GHG emission reductions with all staff. |
| Create (and publicize) a "bright lights" program | Create a staff-based program to celebrate success. Suggest working with the Corporate Communications team and Human Resources to develop a staff recognition program. This could include:<br>• Seeking nominations for staff that have made a difference with energy efficiency<br>• Developing short vignettes<br>• Circulating stories and photos |
| Create an annual staff questionnaire | Include a staff questionnaire to survey staff on corporate climate progress and actions. |
| Ensure open lines of communication | Ensure that staff across the corporation have knowledge of, and access to, a CEEMP information-sharing portal. This portal might be used to:<br>• Share innovative ideas<br>• Identify areas of concern<br>• Provide feedback or solutions |
| Embed results in performance plans | Consider the inclusion of energy and GHG emission reduction targets in select employee's performance reviews. This would serve to recognize specific staff for their success in helping to achieve the CLP targets. |

## Recommendations

The following table includes supporting details for each of the tactics.

### Table 19. Timing and Responsibility of Suggested Communication Tactics

| Tactic | Audiences | Level of Effort | | | | Timing |
|---|---|---|---|---|---|---|
| Host bi-annual CEEMP Steering Committee Meetings | Senior leaders, representing key departments | | | | | Bi-annual, Ongoing |

| Tactic | Audiences | Level of Effort | Timing |
|---|---|---|---|
| Share the results of the CEEMP Steering Committee | Regional Leadership Council | | Bi-annual, Ongoing |
| Develop an annual corporate Energy and GHG Emissions Progress Report | Council<br>All staff | | Annually |
| Implement targeted energy skills training | Specific, pre-identified staff | | End of Year Two |
| Implement general energy skills training | All staff | | End of Year Two |
| Work to integrate key messaging into existing communications | All staff | | End of Year One |
| Create (and publicize) a “Bright Lights” program | All staff | | End of Year One |
| Ensure open lines of communication | All staff | | End of Year One |
| Embed results in performance plans | Specific, pre-identified staff | | End of Year Three |